MAJOR PROJECT PART-2

ANALYSIS OF THREE SPAN CONTINUOUS INTEGRAL BRIDGE

(CANTILEVER CONSTRUCTION)

A Thesis submitted in partial fulfillment of
the requirement for the award of the degree of

MASTER OF TECHNOLOGY
(STRUCTURAL ENGINEERING)

SUBMITTED BY
PRAVEEN KUMAR GUPTA
17/STR/2010

UNDER THE GUIDANCE OF
Shri. G. P. AWADHYA
(Associated Professor)

(Department of Civil & Environmental Engineering)
DELHI TECHNOLOGICAL UNIVERSITY
BAWANA ROAD, DELHI 110042

DECEMBER 2015

Declaration

I declare that this written submission represents my ideas in my own words and where other's ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be the cause for disciplinary action by the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

PRAVEEN GUPTA
Roll No. 17/STR/2010

MAJOR PROJECT PART-2

ANALYSIS OF THREE SPAN CONTINUOUS INTEGRAL BRIDGE

(CANTILEVER CONSTRUCTION)

BY

PRAVEEN KUMAR GUPTA

17/STR/2010

This thesis entitled and authored as above is approved for the award of

MASTER OF TECHNOLOGY

(STRUCTURAL ENGINEERING).

Examiner (s) ________________________________ ____________________

Shri. G P Awadhiya
(Supervisor) ______________________________ ___________________

Dr. Narendra Dev
(Head of Department) _______________ __________________ ______________

Date: ______DECEMBER, 2015

Place: DELHI

Department of Civil & Environmental Engineering

DELHI TECHNOLOGICAL UNIVERSITY

CERTIFICATE

This is to certify that the Major Project Part 2, the Thesis on "LONGITUDINAL ANALYSIS OF CANTILEVER CONSTRUCTED CONTINUOUS INTEGRAL BRIDGE" is a bonafide record of work done by me for partial fulfillment of requirement of award of degree in **Master of Technology (Structural Engineering)** at Delhi Technological University.

This project has been carried out under the supervision of Shri. G. P. Awadhiya, Associate Professor, Delhi Technological University, Delhi.

I, Praveen Gupta have not submitted the matter embodied in this report to any other University or Institution for the award of any Degree or Diploma.

PRAVEEN GUPTA
Roll No. 17/STR/2010

This is to certify that the above statement laid by the candidate is correct to the best of my knowledge.

Mr. G P Awadhiya
Associate.Professor

Acknowledgement:

It is a great pleasure to have the opportunity to extent my heartfelt gratitude to everybody who helped me throughout the course of this project.

It is distinct pleasure to express my deep sense of gratitude and indebtedness to my learned supervisor Prof G P Awadhiya for his invaluable guidance, encouragement and patient reviews. His continuous inspiration has made me complete this Major Project Part 2. He kept on boosting me time and again for putting an extra ounce of effort to realize the work.

I would also like to take this opportunity to present my Sincere regards to H.O.D. Dr. Narendra Dev for his support and encouragement.

I am thankful to our Librarian, Computer centre head and other staff members for providing me unconditional and any time access to the resources.

I am also thankful to my friends for their unconditional support and motivation during this work

PRAVEEN GUPTA
Roll No. 17/STR/2010

Structural Engineering
Civil and Environmental Engineering Department
Delhi Technological University
Delhi 42

LIST OF SYMBOLS

Latin upper case letters

A Accidental action

A Cross- sectional area

A_C Cross- sectional area of concrete

A_p Area of prestressing tendon or tendons

A_s Cross- sectional area of reinforcement

$A_{s,min}$ Minimum cross sectional area of shear reinforcement

A_{sw} Cross-sectional area of shear reinforcement

D Diameter of mandrel

E Effect of action; or general expression for modulus of elasticity as per the context.

E_c Tangent modulus of elasticity of normal weight concrete at a stress of $\sigma_c = 0$.

$E_{c,eff}$ Effective modulus of elasticity of concrete

E_{cd} Design value of modulus of elasticity concrete

E_{cm} Secant modulus of elasticity of concrete

$E_c(t)$ Tangent modulus of elasticity of normal weight concrete at a stress of $\sigma_c = 0$ and time t.

E_p `Design value of modulus of elasticity of prestressing steel

E_s Design value of modulus of elasticity of reinforcement steel

E_I Bending stiffness

E_{qu} Static equilibrium

F Action

F_d Design value of an action

F_k Characteristic value of an action

G_k Characteristic value of permanent action

I Second moment of area of concrete section

L Length

M Bending moment

M_{Ed} Design value of the applied internal bending moment

N Axial force

N_{Ed} Design value of the applied axial force (tension or compression)

P Prestressing force

P_o Initial force at the active end of the tendon immediately after stressing

Q_k Characteristic value of a variable action

Q_{fat} Characteristic fatigue load

R Resistance (also refer 3.1.4)

S Internal forces and moments or first moment of area as per context

SLS Serviceability limit state

T Torsional moment

T_{Ed} Design value of the applied torsional moment

ULS Ultimate limit state

V Shear force

V_{Ed} Design value of the applied shear force

X Refer definition in 3.1.4

Latin lower case letters

α Distance

α Geometrical data

$\Delta\alpha$ Deviational for geometrical data

b Overall width of a cross-section, or actual flange width in a T or L beam

b_w Width of the web of T, I or L beams

d Diameter, Depth

d Effective depth of a cross-section

d_g Largest nominal maximum aggregate size

e Eccentricity

f_{bd} Design value of Ultimate bond stress

f_c Compressive strength of concrete

f_{cd} Design value of concrete compressive strength

f_{ck} Characteristic compressive cube strength of concrete at 28 days

f_{cm} Mean value of concrete cube compressive strength

f_{ctk} Characteristic axial tensile strength of concrete

f_{ctm} Mean value of axial tensile strength of concrete

f_p Tensile strength of prestressing steel

f_{pk} characteristic tensile strength of prestressing steel which is same as f_p corresponding to breaking load given in the relevant IS codes listed in Table 18.2

$f_{p0.1}$ 0.1% proof-stress of prestressing steel

$f_{p0.1k}$ Characteristic 0.1% proof-stress of prestressing steel

$f_{0.2k}$ Characteristic 0.1% proof-stress of reinforcement

f_t Tensile strength of reinforcement

f_{tk} Characteristic tensile strength of reinforcement

f_y Yield strength of reinforcement

f_{yd} Design yield strength reinforcement

f_{yk} Characteristic yield strength of reinforcement

f_{ywd} Design yield of shear reinforcement

h Height

h	Overall depth of a cross-section
I	Radius of gyration
k	Coefficient; Factor
l	(or l or L) Length; Span
l_e	Effective length
m	Mass
r	Radius
$1/r$	Curvature at a particular section
t	Thickness
t	Time being considered
t_0	The age of concrete at the time of loading
u	Perimeter of concrete cross-section, having area A_c
u,v,w	Components of the displacement of a point
x	Neutral axis depth
x,y,z	Coordinates
z	Lever arm of internal forces
n	Exponent for strain in concrete stress block

Greek lower case letters

α	Angle; ratio
β	Angle; ratio; coefficient
γ	Partial factor
γ_A	Partial factor for accidental actions, *A*
γ_C	Partial factor for concrete
γ_F	Partial factor for actions, *F*
γ_G	Partial factor for permanent actions, G
γ_M	Partial factor for material property, taking account of uncertainties in the material property itself, in geometric deviation and in the design model used.
γ_P	Partial factor for actions associated with prestressing, *P*
γ_Q	Partial factor for Variable actions; Q
γ_S	Partial factor for reinforcing or prestressing steel
γ_{Sfat}	Partial factor for reinforcing or prestressing steel under fatigue loading
γ_f	Partial factor for actions without taking account of model uncertainties
γ_g	Partial factor for permanent actions without taking account of model uncertainties
γ_m	Partial factor for a material property, taking account only of uncertainties in the material property
δ	Increment/redistribution ratio
	Reduction factor/distribution coefficient
ε_c	Compressive strain in the concrete
ε_{cl}	Compressive strain in the concrete at the peak stress f_c
ε_{cu}	Ultimate compressive stain in the concrete
ε_u	Strain of reinforcement or prestressing steel at maximum load
ε_{uk}	Characteristic of reinforcement or prestressing steel at maximum load
θ	Angle
λ	Slenderness ratio
μ	Coefficient or friction between the tendons and their ducts
ν	Poisson’s ratio
ν	Strength reduction factor for concrete cracked in shear

ζ Ratio of bond strength of prestressing and reinforcing steel

P Oven-dry density of concrete in kg/m^3

P_{1000} Value of relaxation loss (in %), at 1000 hours after tensioning and at a mean temperature of 20^oC.

P_1 Reinforcement ratio for longitudinal reinforcement

P_W Reinforcement ratio for shear reinforcement

σ_c Compressive stress in the concrete

σ_{cp} Compressive stress in the concrete from axial load or prestressing

σ_{CM} Compressive stress in the concrete at the ultimate compressive strain

τ Torsional shear stress (shear/torsional stress in Annexure A4)

ϕ
- Diameter of a reinforcing bar or of a prestressing duct
- Sometimes used for creep coefficient without further suffixes.

$\phi(t,t_o)$ Creep coefficient, defining creep between times t and t_o, related to elastic deformation at 28 days

$\phi(\infty_g\ t_o)$ Final value of creep

ψ Factors defining representative values of variable actions

ψ_0 for combination values

ψ_1 for frequent values

ψ_2 for quasi-permanent values.

η_k Non-Dimensional ratio of axial load to the capacity of concrete section (without reinforcement).

ABSTRACT

The long span pre-stressed concrete box girder bridges constructed in India before 1990 were free end cantilever bridges constructed monolithic, integral with the substructure. Such bridges have a central hinge which leads large deflection at the centre of the bridge span. These bridges also suffer severe damages at the hinge locations over a period of time. The bridge is made the three span continuous supported on *Poly Tetra Fluro Ethylene* (PTFE) bearings and were constructed before 2010. To avoid this hinge at the centre and make bearing free, integral at interior support and having bearings at both ends have been proposed in this research effort. The bridge has been analysed in MIDAS software. To design the R.C.C. sections using ULS and SLS load factors, OASYS software has been used. It has been observed that stresses in entire superstructure and piers are within acceptable limit and found all correct in all respect with economy and ease of construction.

Keywords: Hinges, Pre-stressed Concrete, Cantilever construction, PTFE Bearings, Integral Bridge.

Table of Contents

CHAPTER 1. Introduction

1.1 Background

Concrete is the most commonly used material in Indian Roads and Highway structures, especially after the wide acceptance of pre-stressing technology in the 1950s. Nowadays, concrete bridges, pre-stressed or non-pre-stressed, account for about 90% of all bridges in the Indian Roads and Highway system. Such dominancy is attributable to the many advantages that concrete offers:

- Ability to be cast in almost any shape
- Low cost
- Durability
- Fire resistance
- Energy efficiency
- On-site fabrication
- Aesthetic properties

Concrete design has evolved from Allowable Stress Design (ASD), also Working Stress Design (WSD), to Ultimate Strength Design (USD) or Load Factor Design (LFD), to today's Limit State Design (LSD) or Load and Resistance Factor Design (LRFD). Concrete design takes on a whole new look and feel in the *IRC 112 -2011 CODE OF PRACTICE FOR CONCRETE BRIDGES* & *Bridge Design Specifications* (MORTH, 2013). New concepts that had been ruminating amongst concrete experts for decades reached a level of maturity appropriate for implementation. While not perfect, the new methods are more rational than those in the *Indian Standard Specifications for Highway Bridges* (IRC Codes and MORTH Specifications) and entail an amount of effort appropriate given today's technology compared to that available when the LFD was developed. Changes include:

- Unified design provisions for reinforced and pre-stressed concrete
- Modified compression field theory for shear and torsion
- Alternative Strut and Tie modeling techniques for shear and flexure
- End zone analysis for tendon anchorages
- New provisions for segmental construction
- Revised techniques for estimating pre-stress losses

1.1.1 Segmental Construction

When segmental construction first appeared in the early 1950s, it was either cast in place as used in Germany by Finsterwalder et al., or precast as used in France by Eugène Freyssinet and Jean Muller. The development of modern segmental construction is intertwined with the development of balanced cantilever construction. By the use of the term *balanced cantilever construction,* we are describing a phased construction of a bridge superstructure. The construction starts from the piers cantilevering out to both sides in such a way that each phase is tied to the previous ones by post-tensioning tendons, incorporated into the permanent structure, so that each phase serves as a construction base for the following one.

Balanced cantilever segmental construction for concrete box-girder bridges has long been recognized as one of he most efficient methods of building bridges without the need for false work. This method has great advantages over other forms of construction in urban areas where temporary shoring would disrupt traffic and services below, in deep gorges, and over waterways where false work would not only be expensive but also a hazard. Construction commences from the permanent piers and proceeds in a “balanced” manner to mid span A final closure joint connects cantilevers from adjacent piers. The structure is hence self-supporting at all stages.

The cantilevers are usually constructed in 3m to 5m long segments. These segments may be cast in place or precast in a nearby purpose-built yard, transported to the specific piers by land, water, or on the completed viaduct, and erected into place.

1.1.2 Typical Post-Tensioning Layout

Post-tensioning tendons may be internal or external to the concrete section, but inside the box girder, housed in steel pipes, or both. External post-tensioning greatly simplifies the casting process and the reduced eccentricities available compared with internal tendons are normally compensated by lower frictional losses along the tendons and hence higher forces. The choice of the size of the tendons must be made in relation to the dimensions of the box girder elements. A minimum number of tendons would be required for the balanced cantilevering process, and these may be anchored on the face of the segments, on internal blisters, or a combination of both. After continuity of opposing cantilevers is achieved, the required number of mid-span tendons may be installed across the closure joint and anchored on internal bottom blisters. Depending on the arrangement and length of the spans, economies may be made by arranging some of the tendons to cross two or more piers, deviating from the top at the piers to the bottom at mid span, thereby reducing the number of anchorages and stressing operations. External post-tensioning is best used for these continuity tendons which would allow longer tendon runs due to the reduced frictional losses. Where the tendons are external to the concrete elements, deviators at piers, quarter span, and mid span are used to achieve the required profile.

1.1.3 Articulation and Hinges

The movements of the structure under the effects of cyclic temperature changes, creep, and shrinkage are traditionally accommodated by provision of halving joint-type hinges at the center of various spans. This practice is now discontinued due to the unacceptable creep deformations that occur at these locations. If such hinges are used, these are placed at contra-flexure points to minimize the effects of long-term deflections. A development on simple halving joints is a moment-resisting joint, which allows longitudinal movements only. All types of permanent hinges that are more easily exposed to the elements of water and salt from the roadway provide maintenance difficulties and should be eliminated or reduced wherever possible.

1.2 Aim

The major goal of this research project is to review, validate, and recommend established procedure for the design of durable and constructible details to achieve structural continuity between the substructure (piers) and, both sides cantilevered arms pre-stressed concrete girder. Additional goals are to obtain longer span-to-depth ratios and greater economy with the consideration of superimposed dead loads and live loads. The objectives of this study are:

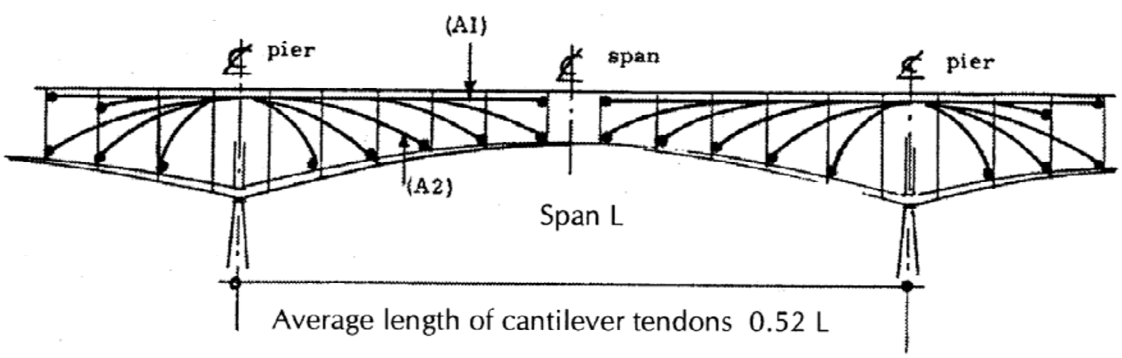
- Design and document the in all respect safe and economical design procedure alternatives for the design and construction of continuous pre-stressed concrete bridge girders supported on the bearings.
- Identify the continuity connection technology that has the potential to extend span lengths providing a simple, constructible, and cost-effective solution.
- Validate the most appropriate connection details and suitable construction procedure.
- Perform detailed design for final evaluation of benefits of continuous bridge girders.
- Recommend three span continuous integral bridges with twin plate piers as an alternative option and identify limitations.

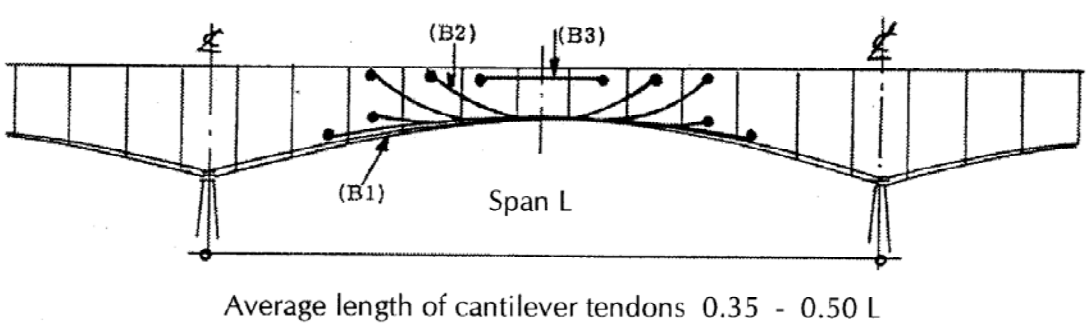
This study focuses on already constructed three span cantilevered bridge in Assam Silchar at Sadarghat constructed by Gammon India Ltd in 1960s and designed in Germany and still the India is seeking the designer to replace the bridge with innovative solution with all life maintenance free structure.

1.3 Scope

Significant traffic and congestion across urban areas, as well as waterways, creates a demand for long-span bridges. The construction of these longer spans plays a critical role in the development of modern infrastructure due to safety, environmental, and economic reasons. A variety of bridge construction practices have been observed over the years. Planning, design and construction techniques are revised and refined to satisfy several parameters including feasibility, ease of construction, safety, maintainability, and economy.

The outcome of this research study will support Public Works Departments and other Governments bodies in the service of the public and India's pride for implementation of continuous integral, pre-stressed concrete bridge girders to achieve longer span-to-depth ratios with greater economy than currently possible the established design steps within India.





CHAPTER 2: Literature review

In this research effort, basic problems faced are the indeterminacy mechanism adopted to ensure the zero tension in the entire pre-stressed concrete box section with the experience of both design and execution of the bridge construction I have tried to plot the stress diagram at top and bottom fibers of the box girder.

Dr. R. S. Talikoti **[Ref-4]**

The impact of time dependent factors and seismicity on analysis of balanced cantilever bridge are studied. Combined impact of seismicity and time dependent properties of the design moment of balanced cantilever bridge is studied by
DISCHINGER'S EQUATION
Moment Variation with Time, leads to following final equation
$Mcr = M_{III} - M_I = (M_{II} - M_I)(1 - e^{-\phi t})$

Where,
Mcr = the creep moment resulting from change of structural system,
M_I = the moment due to loads before a change of structural system,
M_{II} = the moment due to the same loads applied on the changed structural system,
M_{III}= the restraint moment Mt.

Chris Burgoyne **[Ref-2]**

Koror–Babelthuap, 240 m span pre-stressed-concrete bridge in Palau, an island nation in the western Pacific Ocean, collapsed, without warning on 26 September 1996 at around 5.45 pm in benign weather conditions and in the absence of abnormal loads. The parties involved were subject to a confidentiality agreement, so no definitive statement has been made as to the cause of the collapse. This paper reports on a study carried out using information in the public domain. It concludes that a repair carried out six weeks before the collapse was not to blame, but did expose weaknesses in the original design.

Byung-Hwan Oh and Se-Jin-Jin Joen **[Ref-1]**

The methods devised in this study include the use of curvature of tendon, characteristics of primary moment, self equilibrium condition and linear segments approximation of tendon. Section forces produced by the exact equivalent loads for circular Tendon profile at a distance x from left end of the beam are calculated as follows:

Axial force:

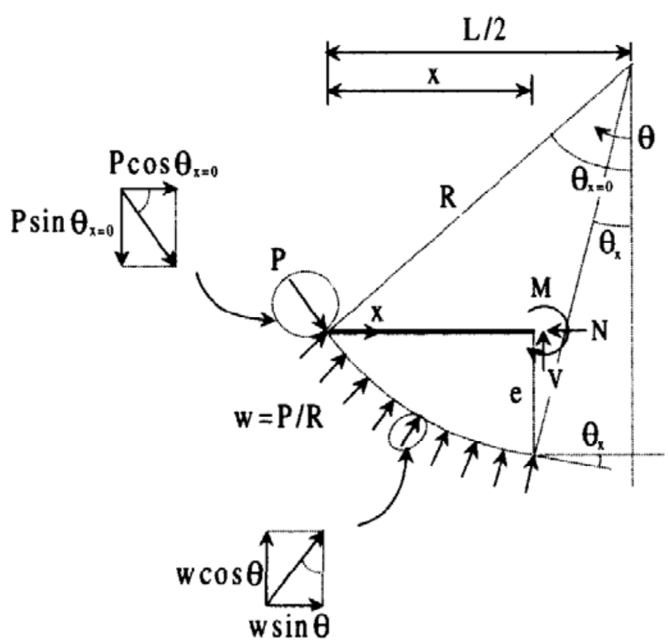
$$N = P\cos\theta_{x=0} + \int_{\theta_x}^{\theta_{x=0}} w\sin\theta R d\theta$$
$$= P\cos\theta_{x=0} - wR\cos\theta\,|_{\cos\theta_x}^{\cos\theta_{x=0}} = P\cos\theta_x \quad \text{(A1)}$$

Shear force:

$$V = P\sin\theta_{x=0} - \int_{\theta_x}^{\theta_{x=0}} w\cos\theta R d\theta$$
$$= P\sin\theta_{x=0} - wR\sin\theta\,|_{\sin\theta_x}^{\sin\theta_{x=0}} = P\sin\theta_x \quad \text{(A2)}$$

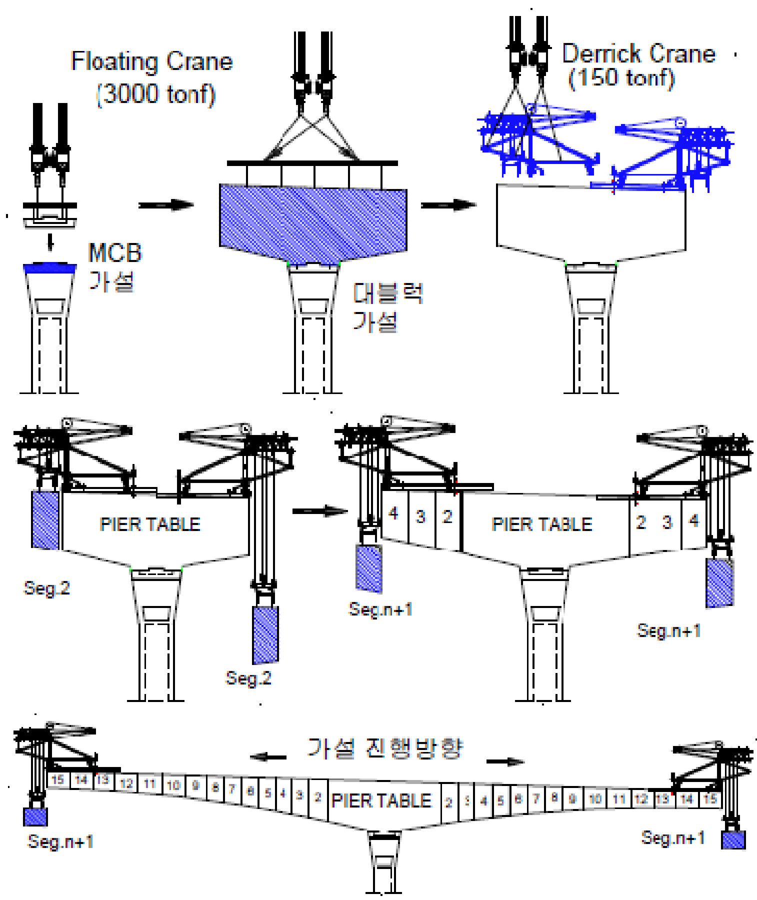
Bending moment:

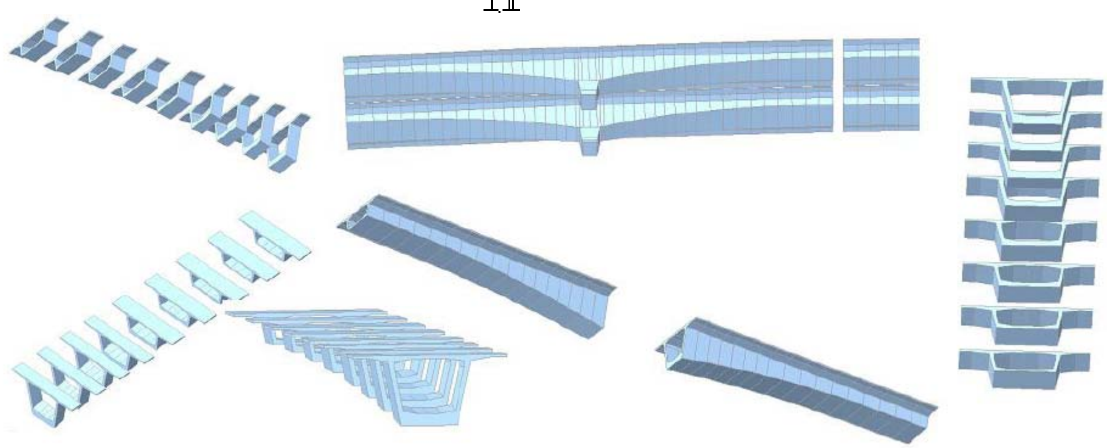
$$M = P\sin\theta_{x=0}x - \int_{\theta_x}^{\theta_{x=0}} w\cos\theta(R\sin\theta - R\sin\theta_x)Rd\theta$$
$$+ \int_{\theta_x}^{\theta_{x=0}} w\sin\theta(R\cos\theta - R\cos\theta_{x=0})Rd\theta$$
$$= P\sin\theta_{x=0}(R\sin\theta_{x=0} - R\sin\theta_x) + \int_{\theta_x}^{\theta_{x=0}} PR\cos\theta\sin\theta_x d\theta \quad \text{(A3)}$$
$$- \int_{\theta_x}^{\theta_{x=0}} PR\sin\theta\cos\theta_{x=0} d\theta$$
$$= PR(\sin\theta_{x=0})^2 - PR\sin\theta_x\sin\theta_{x=0} + PR\sin\theta_x\sin\theta\,|_{\sin\theta_x}^{\sin\theta_{x=0}}$$
$$+ PR\cos\theta_{x=0}\cos\theta\,|_{\cos\theta_x}^{\cos\theta_{x=0}}$$
$$= P\cos\theta_x(R\cos\theta_x - R\cos\theta_{x=0}) = P\cos\theta_x e$$



Kim, Hyung-Tae and Kang, Byung-Seob **[Ref-3]**

This paper presents several major tasks, to be managed by the supervision team in the supervision process for the construction of balance cantilever bridge by various independent construction engineering processes to achieve self-reliant technological judgment and prompt decision-making in order to prepare for any kind of unforeseen event that might happen during the construction of the bridge. Simulation of superstructure girder are as under:

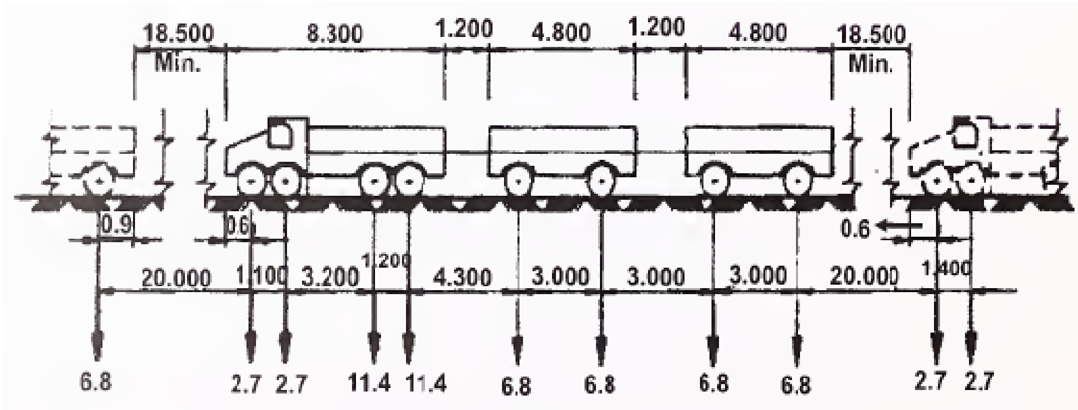




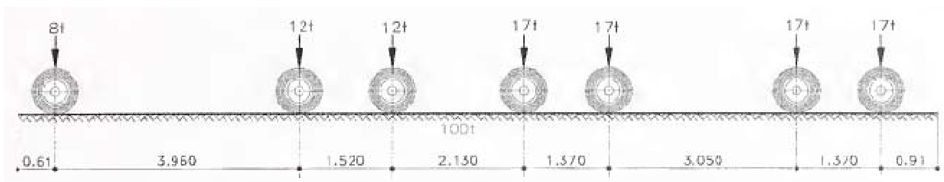
CHAPTER 3. IRC CODE PROVISIONS

3.1 IRC 6 - 2014

Live Load trains

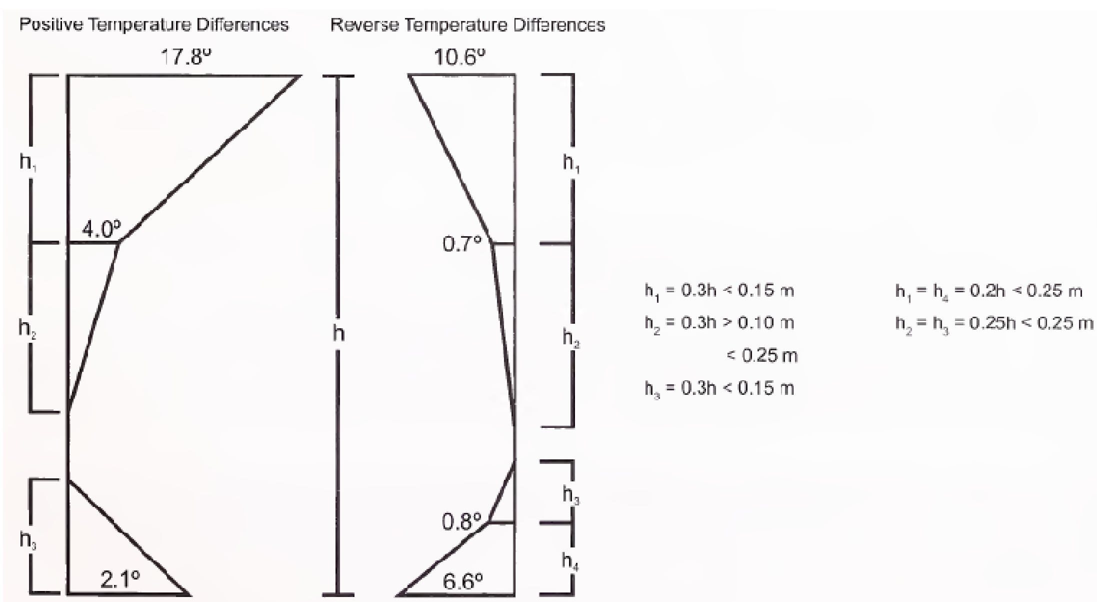


Class A Train of Vehicles



CLASS 70R (WHEELED) - LONGITUDINAL POSITION

Temperature Loading



ULS LOAD FACTOR AS PER IRC 6 2014

Loads	Ultimate Limit State		
	Basic Combination	Accidental Combination	Seismic Combination
(1)	(2)	(3)	(4)
1. Permanent Loads:			
1.1 Dead Load, Snow load (if present), SIDL except surfacing			
a) Adding to the effect of variable loads	1.35	1.0	1.35
b) Relieving the effect of variable loads	1.0	1.0	1.0
1.2 Surfacing			
a) Adding to the effect of variable loads	1.75	1.0	1.75
b) Relieving the effect of variable loads	1.0	1.0	1.0
1.3 Prestress and Secondary effect of prestress	(Refer Note 2)		
1.4 Back fill Weight	1.5	1.0	1.0
1.5 Earth Pressure due to Backfill			
a) Adding to the effect of variable loads	1.5	1.0	1.5
b) Relieving the effect of variable loads	1.0	1.0	1.0
2. Variable Loads:			
2.1 Carriageway Live load and associated loads (braking, tractive and centrifugal) and Footway live load			
a) As leading load	1.5	0.75	-
b) As accompanying load	1.15	0.2	0.2
c) Construction live load	1.35	1.0	1.0
2.2 Wind Load during service and construction			
a) As leading load	1.5	-	-
b) As accompanying load	0.9	-	-
2.3 Live Load Surcharge effects (as accompanying load)	1.2	0.2	0.2
2.4 Construction Dead Loads (such as Wt. of launching girder, truss or Cantilever Construction Equipments)	1.35	1.0	1.35
3. Accidental effects:			
3.1 Vehicle collision (or)	-	1.0	-
3.2 Barge Impact (or)	-	1.0	-
3.3 Impact due to floating bodies	-	1.0	-
4. Seismic Effect			
(a) During Service	-	-	1.5
(b) During Construction	-	-	0.75
5. Hydraulic Loads (Accompanying Load):			
5.1 Water current forces	1.0	1.0	1.0
5.2 Wave Pressure	1.0	1.0	1.0
5.3 Hydrodynamic effect	-	-	1.0
5.4 Buoyancy	0.15	0.15	1.0

SLS LOAD FACTOR AS PER IRC 6 2014

Loads	Rare Combination	Frequent Combination	Quasi-permanent Combination
(1)	(2)	(3)	(4)
1. Permanent Loads:			
1.1 Dead Load, Snow load if present, SIDL except surfacing	1.0	1.0	1.0
1.2 surfacing			
a) Adding to the effect of variable loads	1.2	1.2	1.2
b) Relieving the effect of variable loads	1.0	1.0	1.0
1.3 Earth Pressure Due to Back fill weight	1.0	1.0	1.0
1.4 Prestress and Secondary Effect of prestress	(Refer Note 4)		
1.5 Shrinkage and Creep Effect	1.0	1.0	1.0
2. Settlement Effects			
a) Adding to the permanent loads	1.0	1.0	1.0
b) Opposing the permanent loads	0	0	0
3. Variable Loads:			
3.1 Carriageway load and associated loads (braking, tractive and centrifugal forces) and footway live load			
a) Leading Load	1.0	0.75	-
b) Accompanying Load	0.75	0.2	0
3.2 Thermal Load			
a) Leading Load	1.0	0.60	-
b) Accompanying Load	0.60	0.50	0.5
3.3 Wind Load			
a) Leading Load	1.0	0.60	-
b) Accompanying Load	0.60	0.50	0
3.4 Live Load surcharge as accompanying load	0.80	0	0
4. Hydraulic Loads (Accompanying loads) :			
4.1 Water Current	1.0	1.0	-
4.2 Wave Pressure	1.0	1.0	-
4.3 Buoyancy	0.15	0.15	0.15

3.2 IRC 12 – 2011

Design Service Life

Nomenclature of Design Service life	Useful life	Example
Normal	100 years or more	All bridges unless otherwise specifically classified by owner
Temporary	10 years or less	1) Bridge on temporary access roads. 2) Bridge for constructional facility.
Special Applications	Up to 20 years or as specified by the owner	1) Bridge rehabilitated for a short term. 2) Bridge for projects/industries with planned economic life of short duration.

M_{Rd}, **Bending resistance**

(1) Determine the distance between the temporary neutral axis and the extreme fiber of concrete that is in compression. When the strain of compression extreme fiber is ε_{cu2} or ε_{cu3}, calculate strain ε_s and $\Delta\varepsilon_p$ for reinforced and Prestressing steel.

(2) Calculate F_c (Concrete), F_s (Steel) and F_p (Tendon)

$$F_c = \lambda x \times \eta f_{cd}$$

$$F_s = f_s A_s \quad , \quad f_s = \varepsilon_s E_s$$

$$F_p = f_p A_p \quad , \quad f_p = \varepsilon_p E_p ,$$

$$\varepsilon_p = \Delta\varepsilon_p + \varepsilon_{p(0)}$$

Note: For Unbonded Tendons value of $\varepsilon_{p(0)} = 100 / E_p$

(3) $C = T$

$$F_c - (F_s + F_p) < \Delta$$

(4) Determine depth of the neutral axis (x)

Repeat 1) ~2) to satisfy (3) (by trial and error)

(5) M_{Rd}, bending resistance

From the determined neutral axis depth, calculate M_{Rd}

$M_{Rd} = F_c a_c + F_s a_s + F_p a_p$ (a = distance from the neutral axis)

Elem	Element number	V_{Ed}	maximum shear force among Strength/Stress load combinations
Part	location of check (I-end, J-end)	V_{Rd}	shear resistance
Max/Min	maximum/minimum shear force	$V_{Rd,c}$	shear resistance of Concrete
LCom Name	Load combination name	$V_{Rd,s}$	shear resistance of shear reinforcement
Type	produce maximum and minimum member force components for the load combinations including moving load cases	$V_{Rd,max}$	maximum $V_{Rd,s}$
Check	OK/NG	V_{Ed} / V_{Rd}	the ratio of shear force to shear resistance

Shear resistance $V_{Rd,c}$

$$V_{Rd,c} = \left[C_{Rd,c} k (100 \rho_1 f_{ck})^{1/3} + k_1 \sigma_{cp}\right] \cdot b_w d$$

With a minimum of

$$V_{Rd,c} = (v_{min} + k_1 \sigma_{cp}) \cdot b_w d$$

(Where the flexural tensile stress is smaller than $f_{ctk,0.05} / \gamma_c$)

$$V_{Rd,c} = \frac{I b_w}{S} \sqrt{(f_{ctd})^2 + \alpha_l \sigma_{cp} f_{ctd}}$$

Shear resistance, $V_{Rd,s}$

$$V_{Rd,s} > V_{Ed} - V_{Rd,c}$$

For members with vertical shear reinforcement

$$V_{Rd,s} = \frac{A_{sw}}{s} z f_{ywd} \cot\theta$$

$$V_{Rd,max} = \alpha_{cw} b_w z v_1 f_{cd} / (\cot\theta + \tan\theta)$$

For members with inclined shear reinforcement

$$\frac{A_{sw,max} f_{ywd}}{b_w s} \le \frac{1}{2} \alpha_{cw} v_1 f_{cd}$$

$$V_{Rd,s} = \frac{A_{sw}}{s} z f_{ywd} (\cot\theta + \cot\alpha) \sin\alpha$$

$$V_{Rd,max} = \alpha_{cw} b_w z v_1 f_{cd} / (\cot\theta + \cot\alpha) / (1 + \cot^2\theta)$$

$$\frac{A_{sw,max} f_{ywd}}{b_w s} \le \frac{\frac{1}{2}\alpha_{cw} v_1 f_{cd}}{\sin\alpha}$$

Where α is the Angle of Diagonal reinforcement.

Where the web contains grouted ducts with a diameter $\phi > b_w / 8$

$$b_{w,nom} = b_w - 0.5\sum\phi$$

Where ϕ is the outer diameter of the duct and $\sum\phi$ is determined for most

Unfavorable level

For grouted metal ducts with $\phi \le b_w / 8$, $b_{w,nom} = b_w$

For non-grouted ducts, grouted plastic ducts and unbonded tendons

$$b_{w,nom} = b_w - 1.2\sum\phi$$

Elem	Element number	T_{Ed}	maximum torsional moment among Strength/Stress load combinations
Part	location of check (I-end, J-end)	$T_{Rd,max}$	Design torsional resistance moment
Max/Min	Check for three cases, T-Max, V-Max and V-min.	V_{Ed}	maximum shear force among Strength/Stress load combinations
LCom Name	Load combination name	$V_{Rd,s}$	shear resistance of shear reinforcement
Type	Produce maximum and minimum member force components for the load combinations including moving load cases	$V_{Rd,max}$	maximum $V_{Rd,s}$

$V_{Rd,max}$: $V_{Rd,max} = \alpha_{cw} b_w z \nu_1 f_{cd} / (\cot\theta + \cot\alpha) / (1 + \cot^2\theta)$

The maximum resistance of a member subjected to torsion and shear

For solid cross-sections:

$T_{Ed} / T_{Rd,max} + V_{Ed} / V_{Rd,max} \leq 1.0$

T_{Ed} is the design torsional moment

V_{Ed} is the design transverse force

$T_{Rd,max}$ is the design torsional resistance moment according to

$$T_{Rd,max} = 2\nu\alpha_{cw} f_{cd} A_k t_{ef,i} \sin\theta \cos\theta$$

$$t_{ef,i} = A / u$$

For box sections

Each wall should be designed separately for combined effects of shear and torsion. The ultimate limit

State for concrete should be checked with reference to the design shear resistance

Calculate allowable stress

The concrete compressive stress in the structure

$\sigma_c \leq 0.6 f_{ck}(t)$

For pretension elements, $k_6 f_{ck}(t)$

Tensile strength

$$f_{ctm}(t) = (\beta_{cc}(t))^{\alpha} \cdot f_{ctm}$$

Maximum stress applied to the tendon

$$\sigma_{p,max} = \min\{k_1 f_{pk} \;;\; k_2 f_{p0,1k}\}$$

Prestressing tendons (AFDL2)

$$\sigma_p = k_5 f_{pk}$$

k_5 The recommended value 0.75

Calculate allowable stress

Allowable compressive stress

$\sigma_c = k_1 f_{ck}$

Note: k_1 from National Annex. The recommended value is 0.6

Allowable tensile stress

$\sigma_{ct} = f_{ctm}$

$w_k = s_{r,max}(\varepsilon_{sm} - \varepsilon_{cm})$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_s - k_t \dfrac{f_{ct,eff}}{\rho_{p,eff}}(1 + \alpha_e \rho_{p,eff})}{E_s} \geq 0.6\frac{\sigma_s}{E_s}$$

$s_{r,max} = k_3 c + k_1 k_2 k_4 \phi / \rho_{p,eff}$

ϕ is the bar diameter.

$$\phi = \frac{n_1\phi_1^2 + n_2\phi_2^2}{n_1\phi_1 + n_2\phi_2}$$

If, spacing $> 5(c + \phi/2)$,

$s_{r,max} = 1.3(h - x)$

Check crack

$w_k < w_{max}$

w_{max} = Table 7.101N-Recommended value of w_{max} and relevant combination rules

Tensioned Tendons and External Unbonded Tendons

Type of high Tensile Steel	Type of Duct or Sheath	Values recommended to be used in design	
		k per metre	μ
Wire cables	Bright metal steel	0.0091	0.25
	Galvanised steel	0.0046	0.20
	Lead coated steel	0.0046	0.18
	Unlined duct in concrete	0.0046	0.45
Uncoated Stress Relieved Strands	Bright Metal steel	0.0046	0.25
	Galvanised steel	0.0030	0.20
	Lead coated	0.0030	0.18
	Unlined duct in concrete	0.0046	0.50
	Corrugated HDPE	0.0020	0.17

CHAPTER 4. Design Methodology

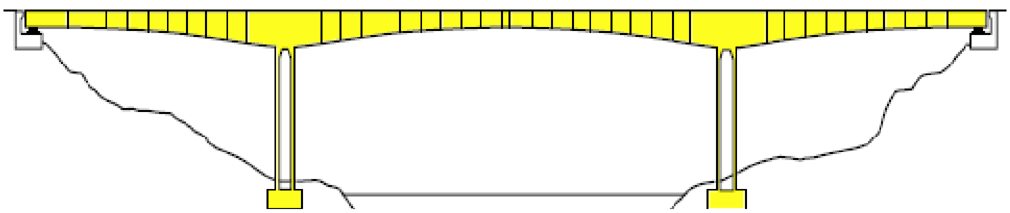
4.1 Description

The following loads are taken into consideration to analysis and design of the structure.

Dead Load:	RCC, PCC and Prestressed Concrete	2.5t/m3
Superimposed Dead Load:	(Maximum) 11.0 t/m	

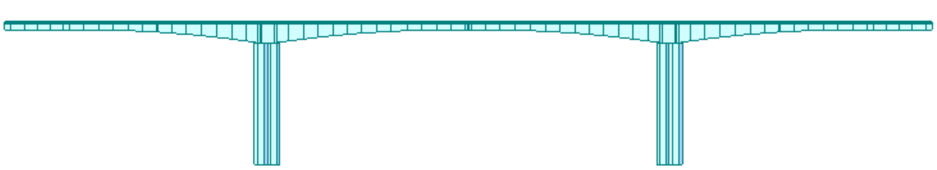
Spans of 80 to 150m are preferred for bridges with pre-stressed concrete box girder decks built by the cantilever method. This construction method consists of erecting the majority of a bridge deck without false-work or scaffolding at ground level, by working in consecutive sections known as segments, each of which is cantilevered out from the preceding segment. After a segment is built, the pre-stressing tendons fixed to the extremities are tensioned, firmly attaching them to the preceding segments and thus forming a self-supporting cantilever which serves as a support for the subsequent operations.

Construction is carried out as symmetrically in general, either side of a pier in order to minimize the moments transmitted to this support during erection; the resulting double overhang is called a balanced cantilever.



Construction Stage Analysis: Construction Sequence may lead to critical force effects which may lead to shear or flexural failure

- Long Unsupported cantilever sections may induce forces which may be substantially different from those in completed structure:
- Time Dependent material properties also play a major role in segmental bridge construction



4.2 Reference example: **[Ref 6]**

All units are in inch, feet and kips

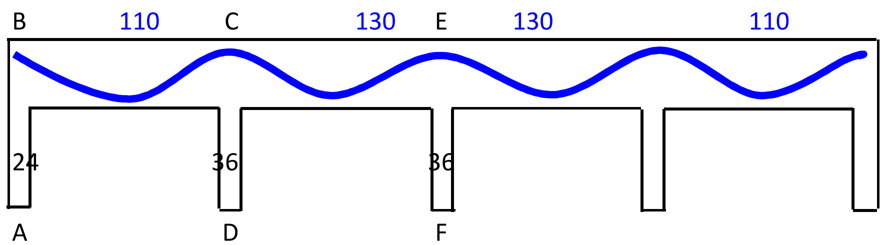
Four span post-tensioned portal structure

Design DATA

Cross section of Girder		60	x	78	inch		I_{BEAM}	2372760
Cross section of Column	BA	60	x	24	Height	23	I_{BA}	69120
	CD	60	x	36		23	I_{CD}	233280

The girder is supported

E_C	at the time of prestressing	4000
Step	1	
Height of column		240



Calculation of Beam Fixed End Moment

Fixed End Moment	BC	CB	CE	EC
Prestressing force	4500	4500	4500	
Eccentricity (as per profile)	2.642	0.358	0.683	
Fixed End Moment	11888	1613	3075	3075

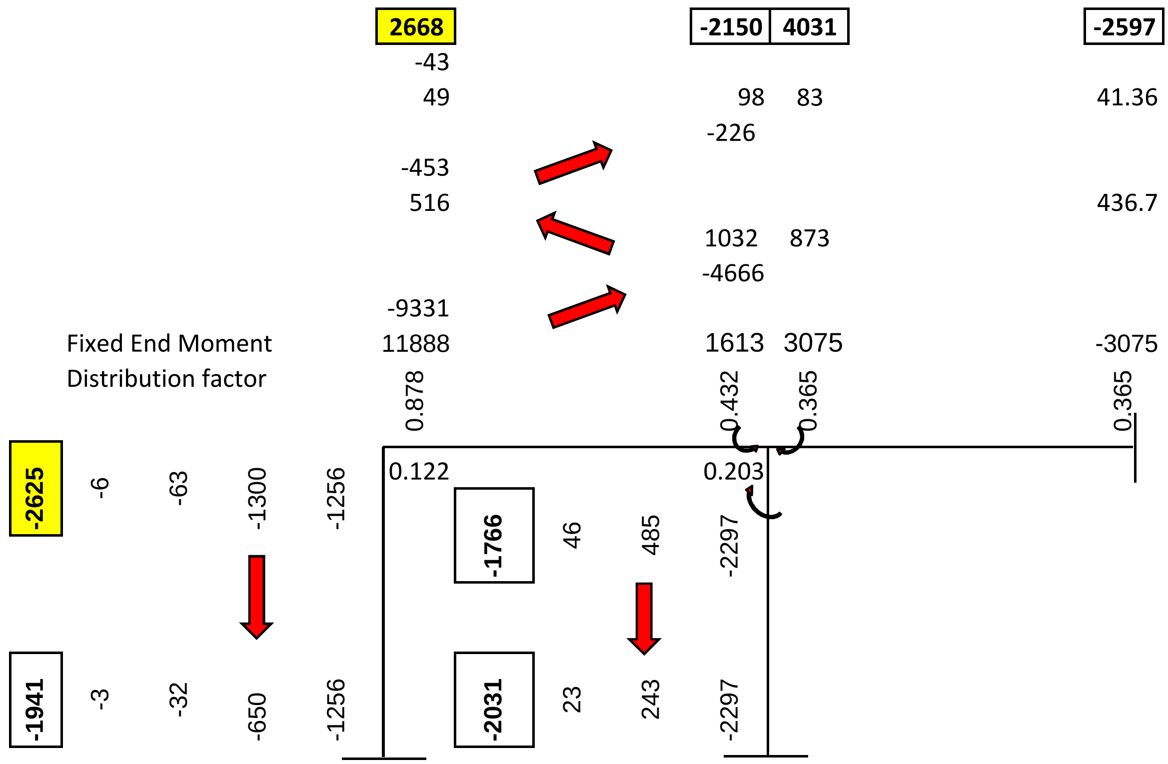
B to E	C to E		
L	L		
240	130		
Δ_B	Δ_C		
0.692	0.375		
Moment	Moment		
BA	CD		
AB	DC		
1256	2297	Factor	12

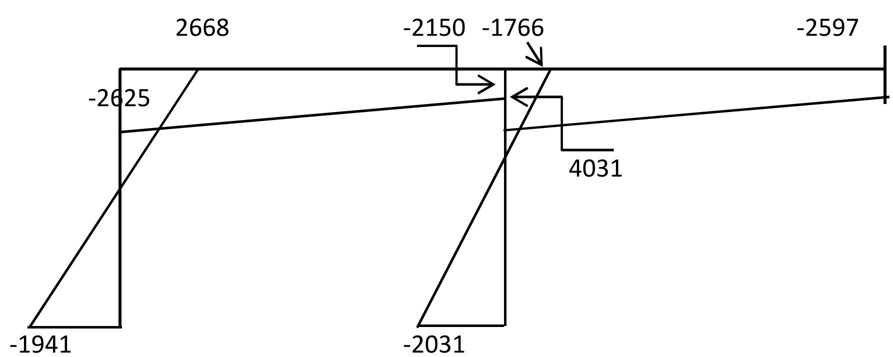
The column moments are based on assumption that the beam will shorten the full amount. In fact the columns will restrain the shortening of the beams and hence the Δ value will be somewhat smaller and so the resultant fixed end moments will be a little smaller than those calculated.

Step 2 Calculations of distribution factores

Joint	B		C		
	K_{BA}	K_{BC}	K_{CB}	K_{CD}	K_{CE}
	48083478	345128727	345128727	162281739	292032000
	0.122	0.878	0.432	0.203	0.365

JOINTS	A	B		C			E	
MEMBERS	M_{AB}	M_{BA}	M_{BC}	M_{CB}	M_{CD}	M_{CE}	M_{EC}	M_{EF}
DISTRIBUTION F.	K_{AB}	K_{BA}	K_{BC}	K_{CB}	K_{CD}	K_{CE}	K_{EC}	K_{EF}
	1	0.122	0.878	0.432	0.203	0.365		





Restraint moment due to prestressing
(Tension side BMD)

4.3 Sequential steps in MIDAS

The sequence for construction stage analysis is outlined.

1. Define material and section
2. Structure modeling
3. Define Structure Group
4. Define Boundary Group
5. Define Load Group
6. Input Load
7. Arrange tendons
8. Pre-stress tendons
9. Define time dependent material property
10. Perform structural analysis
11. Review results

The loads are integrated and stored as the cases below.

Dead Load (CS)	: Dead load including Self Weight included in construction stages
Erection Load (CS)	: Erection load defined by Load Cases to be Distinguished from Dead Load for CS Output of Construction Stage Analysis Control
Tendon Primary (CS)	: Analysis results due to pre-stressing forces in tendons
Tendon Secondary (CS)	: Indeterminate forces resulting from indeterminate condition of the structure
Creep Primary (CS)	: Results the loads causing creep strain
Creep Secondary (CS)	: Real member forces resulting from creep strain due to indeterminate structure
Shrinkage Primary (CS)	: Results for the loads causing shrinkage strain
Shrinkage Secondary (CS)	: Real member forces resulting from shrinkage strain due to indeterminate structure
Summation (CS)	: Summation of the results of all the cases above

Strength/Stress The corresponding load combination is applied in the post-processing mode (Concrete Design tab) except for the serviceability check (crack and fatigue checks).

4.4 Load combinations

Following load combinations are considered for superstructure design:

Load Combination I	= Dead + Pre-stress
Load Combination II	= Dead + Pre-stress + Creep and Shrinkage loss
Load Combination III	= Dead + Pre-stress + Creep and Shrinkage loss + SIDL
Load Combination IV	= Dead + Pre-stress + Creep and Shrinkage loss + SIDL + Creep and Shrinkage loss up to Infinity.
Load Combination V	= Combination III + Live load
Load Combination VI	= Combination IV + Live load
Load Combination VIII	= Combination VI + Temperature
Load Combination X	= Seismic upward
Load Combination XI	= Seismic downward (DN)
Load Combination XII	= Normal Case with differential settlement
Load Combination XII	= Seismic DN Case with Temperature & differential settlement

SLS Combinations

Group 1 – 1.0 DL + 1.2 SIDL + 1.1 (LL + I + LF + CF)
Group 2a – 1.0 DL + 1.2 SIDL + 1.0 EQ
Group 2b – 1.0 DL + 1.2 SIDL + 0.5 (LL + I + LF + CF) + 1.0 EQ
Group 3 – 1.0 DL + 1.2 SIDL + 0.5 (LL + I + LF + CF)

ULS Combinations

Group 1 – 1.25 DL + 2.00 SIDL + 1.75 (LL + I + LF + CF)
Group 2a – 1.25 DL + 2.00 SIDL + 1.6 EQ
Group 2b – 1.25 DL + 2.00 SIDL + 0.7 (LL + I + LF + CF) + 1.25 EQ

Where : DL : Dead Load
SIDL : Superimposed Dead Load
LL : Live Load
I : Impact Factor
LF : Longitudinal Force (Tractive / Braking)
CF : Centrifugal Force

Under SLS combination

Crack width control shall be satisfied and under all SLS combinations as stated above, stress limitations criteria shall be satisfied. The crack width shall be restricted to 0.2mm (at minimum specified cover from face of reinforcement bar).

Compressive stress in concrete shall be restricted to 0.5 fck while tensile stress in steel shall be restricted to 0.75 fy.For pre-stressed superstructure, following load cases shall be considered:

SLS Combinations (Service Stage)

Group 1 – 1.0 DL + 1.2 SIDL + 1.1 (TW + I)
Group 2a – 1.0 DL + 1.2 SIDL + 1.0 EQ
Group 2b – 1.0 DL + 1.2 SIDL + 0.5 (TW + I + LF) + 1.0 EQ
Group 3 – 1.0 DL + 1.2 SIDL + 0.5 (TW + I) + 0.8DT

SLS Combinations (Construction Stage)

Group 1 – 1.0 DL + 1.2 SIDL
Group 2 – 1.0 DL + 1.2 SIDL + 0.5EQ

CHAPTER 5

DESIGN OF BRIDGE

THREE SPAN CONTINUOUS

INTEGRAL BRIDGE

5.1 Descriptions of Bridge

·Bridge type	: PSC Box Girder Bridge (Cast-In-Situ)
·Span arrangement	: 65m+123m+65m=253m
·Width of girder	:12.00m
·Girder height	:7.50m ~ 3.50m(Main Span)
Foundation type	Pile Foundation

5.1.1 Materials & Stress Limit

Pier	Grade of concrete	fck
P6		50
P7		50
Piles	Pile cap	35
Superstructure		50

5.1.2 Concrete

Compressive strength of concrete at the time of prestressing fci	40 Mpa
Considering real const. schedule, compressive strength of conc. at time of prestressing, fci is developed upto	29.9 MPa
during the cantilever construction, and fci at introduction of span and external cables is developed upto 28 days	50 MPa
Moreover critical stress is observed on segments when the age is more than 28 days. Therefore the value of fci	40 MPa
for checking of stress during construction can be taken conservatively	
Allowable stress before losses is as follows:	
Allowable compressive stress	24 MPa
Allowable tensile stress	1.58 MPa
Allowable stress at service limit state after losses is as follows:.	
Allowable compressive stress	30 MPa
Allowable compressive stress due to permanent load	22.5 MPa
Allowable tensile stress	0 MPa

5.1.3 Steel Reinforcement

Characteristics Strength (Yield strength) is taken as 0.2% proof strength	fy	=	500	MPa
Young modulus is taken as	Es	=	200000	MPa
Volumetric weight	γ	=	78.5	kN/m^3

5.1.4 Prestressing Steel

Prestressing Steel characteristic values are as follows:

Nominal diameter of strand			15.24 mm
Nominal cross sectional area of strand			140 mm^2
Ultimate tensile strength of strand	fpu		1860 kN/m^2
Minimum breaking load of strand			260.4 kN
0.2% Proof (Yield) strength of strand	fpy	89.80%	1670 kN/m^2
Elastic modulus			

Relaxation after 1000 hr at 20 °C and 70% of breaking load 2.5%

Allowable stresses for prestressing tendon are as follows:

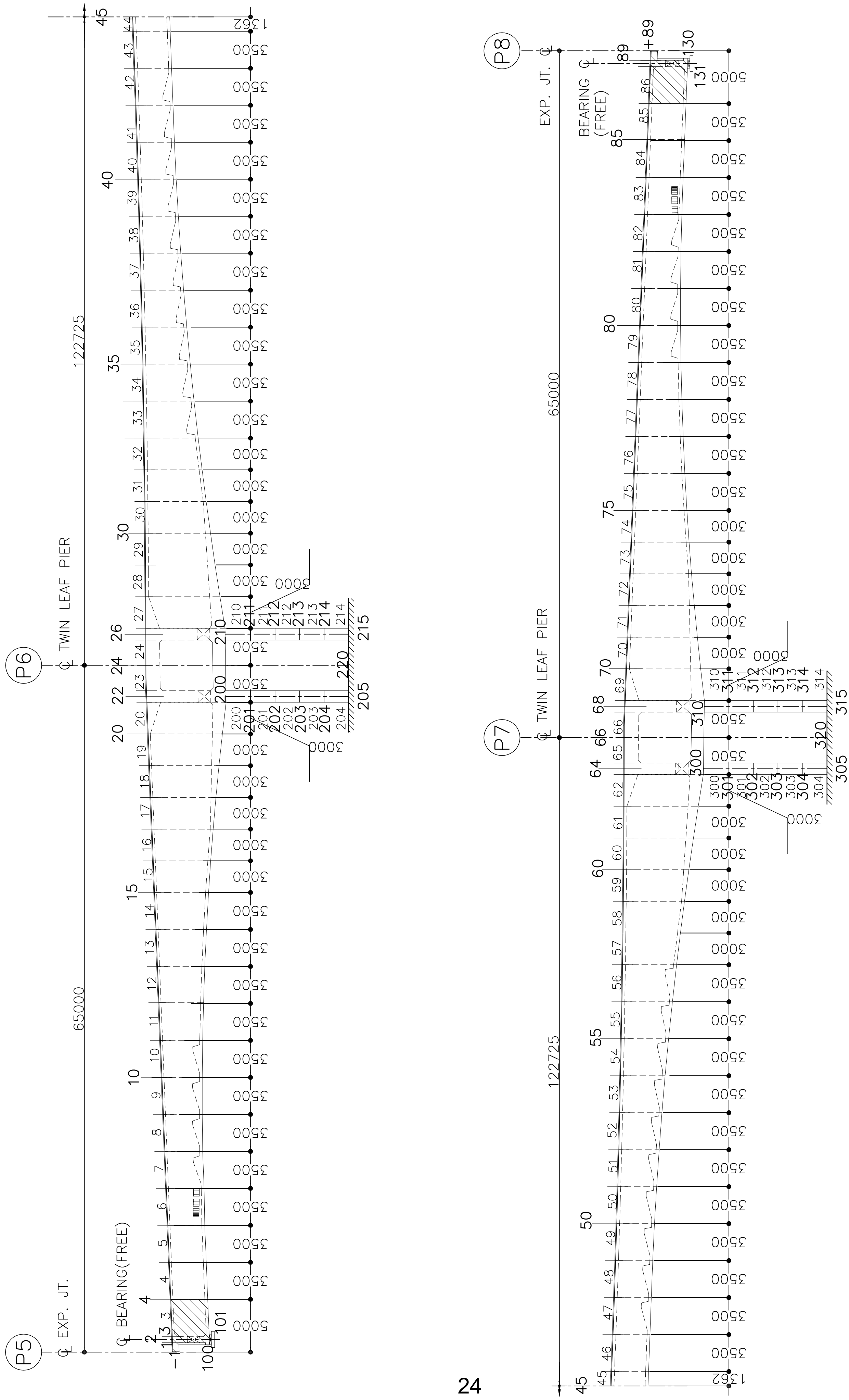
At anchorage and couplers immediately after anchor loss	0.7	1302 MPa
At end of the seating loss zone immediately anchor set	0.74	1376 MPa
Prior to seating - short - term fs may be allowed	0.9	1503 MPa
At service limit state after loss	0.8	1336 MPa

Prestress loss calculation and tendon extension calculation are based on the following assumption:

Prestressing	Friction Coefficient	Wobble coefficient
Internal prestressing	0.2 rad^{-1}	0.002 m^{-1}
External prestressing	0.15 rad^{-1}	0 m^{-1}
Wedge draw in-length	6 mm	6 mm

5.1.5 **Design Data :** SADARGHAT

Central span for Design		=	123.0	m
Side R (Supported on PTFE Bearings)		=	65.00	m
Formation level along C of carriage way at pier		=	109.371	m
H.F.L.		=	99.95	m
Mean Flood Level during seismic		=	99.95	m
L.W.L.		=	88.000	m
Lowest Bed level		=	86.000	m
M.S.L. Level (Normal Case)		=	75.090	m
M.S.L. Level (Seismic Case Case)		=	77.576	m
Thickness of wearing coat			0.075	m
Depth of Superstructure at pier		=	7.500	m
Soffit Level			101.796	m
Height of bearing + pedestal		=	0.000	m
Pier cap top level			101.796	m
Thickness of pier cap			0.000	m
Pile cap top level		=	90.10	m
Depth of pile cap		=	2.100	m
Size of pile cap	21.7	x	12.65	
Width of Carriageway		=	7.500	m
Width of footpath		=	1.500	m
Overall width of deck			12.00	m
Clear height of the pier		=	11.70	m
For design purpose Clear height of the pier		=	11.70	m
No. of parts in MIDAS model	5	Height of each	2.340	m



P5
EXP. JT.
BEARING(FREE)
65000
P6
TWIN LEAF PIER
122725
P7
TWIN LEAF PIER
65000
P8
EXP. JT.
BEARING
(FREE)

Arm Length	apex	start	base half	Min d	Max d
Side end	45.875	0	45.875	3.5	7.5
Centre End	45.875	0	45.875	3.5	7.5

0

Deck width	Deck slab C	Canti Length	Canti tip thk	Bottom Width	Canti haunch		Box Deck haunch		Box Soffit haunch	
12.000	0.275	3.250	0.200	5.500	0.350	1.700	0.275	0.825	0.15	0.300

Node No.	Distance	Sec No.	Element No.	Element Length	Box Depth	Web Thick	Soffit	Free Length	Node No.	Distance	Sec No.	Element No.	Element Length
1	0.000	P6AJ23						60.675					
2	0.500	P6AJ22	1	0.5	3.50	0.350	0.275	60.175	46	127.025	P7RJ20	45	1.3625
3	1.000	P6AJ21	2	0.5	3.50	0.350	0.275	59.675	47	130.525	P7RJ19	46	3.5
4	4.300	P6AJ20	3	3.3	3.50	0.350	0.275	56.375	48	134.025	P7RJ18	47	3.5
5	7.800	P6AJ19	4	3.5	3.50	0.350	0.275	52.875	49	137.525	P7RJ17	48	3.5
6	11.300	P6AJ18	5	3.5	3.50	0.350	0.275	49.375	50	141.025	P7RJ16	49	3.5
7	14.800	P6AJ17	6	3.5	3.50	0.350	0.275	45.875	51	144.525	P7RJ15	50	3.5
8	18.300	P6AJ16	7	3.5	3.52	0.350	0.275	42.375	52	148.025	P7RJ14	51	3.5
9	21.800	P6AJ15	8	3.5	3.59	0.350	0.275	38.875	53	151.525	P7RJ13	52	3.5
10	25.300	P6AJ14	9	3.5	3.71	0.400	0.275	35.375	54	155.025	P7RJ12	53	3.5
11	28.800	P6AJ13	10	3.5	3.87	0.400	0.275	31.875	55	158.525	P7RJ11	54	3.5
12	32.300	P6AJ12	11	3.5	4.08	0.400	0.275	28.375	56	162.025	P7RJ10	55	3.5
13	35.800	P6AJ11	12	3.5	4.34	0.400	0.275	24.875	57	165.525	P7RJ9	56	3.5
14	39.300	P6AJ10	13	3.5	4.64	0.400	0.275	21.375	58	168.525	P7RJ8	57	3
15	42.800	P6AJ9	14	3.5	4.99	0.400	0.275	17.875	59	171.525	P7RJ7	58	3
16	45.800	P6AJ8	15	3	5.33	0.450	0.275	14.875	60	174.525	P7RJ6	59	3
17	48.800	P6AJ7	16	3	5.70	0.450	0.275	11.875	61	177.525	P7RJ5	60	3
18	51.800	P6AJ6	17	3	6.10	0.450	0.357	8.875	62	180.525	P7RJ4	61	3
19	54.800	P6AJ5	18	3	6.54	0.450	0.439	5.875	63	183.400	P7RJ3	62	2.875
20	57.800	P6AJ4	19	3	7.01	0.450	0.521	2.875	64	184.025	P7RJ2	63	0.625
21	60.675	P6AJ3	20	2.875	7.50	0.450	0.600	0.000	65	184.650	P7RJ1	64	0.625
22	61.300	P6AJ2	21	0.625	7.50	0.450	0.600	0.000	66	187.025	P7J0	65	2.375
23	61.925	P6AJ1	22	0.625	7.50	0.450	0.600	0.000	67	189.400	P7AJ1	66	2.375
24	64.300	P6J0	23	2.375	7.50	0.450	0.600	0.000	68	190.025	P7AJ2	67	0.625
25	66.675	P6RJ1	24	2.375	7.50	0.450	0.600	0.000	69	190.525	P7AJ3	68	0.5
26	67.300	P6RJ2	25	0.625	7.50	0.450	0.600	0.000	70	193.525	P7AJ4	69	3
27	67.925	P6RJ3	26	0.625	7.50	0.450	0.600	0.000	71	196.525	P7AJ5	70	3
28	70.800	P6RJ4	27	2.875	7.01	0.450	0.521	2.875	72	199.525	P7AJ6	71	3
29	73.800	P6RJ5	28	3	6.54	0.450	0.439	5.875	73	202.525	P7AJ7	72	3
30	76.800	P6RJ6	29	3	6.10	0.450	0.357	8.875	74	205.525	P7AJ8	73	3
31	79.800	P6RJ7	30	3	5.70	0.450	0.275	11.875	75	208.525	P7AJ9	74	3
32	82.800	P6RJ8	31	3	5.33	0.450	0.275	14.875	76	212.025	P7AJ10	75	3.5
33	85.800	P6RJ9	32	3	4.99	0.400	0.275	17.875	77	215.525	P7AJ11	76	3.5
34	89.300	P6RJ10	33	3.5	4.64	0.400	0.275	21.375	78	219.025	P7AJ12	77	3.5
35	92.800	P6RJ11	34	3.5	4.34	0.400	0.275	24.875	79	222.525	P7AJ13	78	3.5
36	96.300	P6RJ12	35	3.5	4.08	0.400	0.275	28.375	80	226.025	P7AJ14	79	3.5
37	99.800	P6RJ13	36	3.5	3.87	0.400	0.275	31.875	81	229.525	P7AJ15	80	3.5
38	103.300	P6RJ14	37	3.5	3.71	0.400	0.275	35.375	82	233.025	P7AJ16	81	3.5
39	106.800	P6RJ15	38	3.5	3.59	0.350	0.275	38.875	83	236.525	P7AJ17	82	3.5
40	110.300	P6RJ16	39	3.5	3.52	0.350	0.275	42.375	84	240.025	P7AJ18	83	3.5
41	113.800	P6RJ17	40	3.5	3.50	0.350	0.275	45.875	85	243.525	P7AJ19	84	3.5
42	117.300	P6RJ18	41	3.5	3.50	0.350	0.275	49.375	86	247.025	P7AJ20	85	3.5
43	120.800	P6RJ19	42	3.5	3.50	0.350	0.275	52.875	87	250.325	P7AJ21	86	3.3
44	124.300	P6RJ20	43	3.5	3.50	0.350	0.275	56.375	88	250.825	P7AJ22	87	0.5
45	125.663		44	1.3625	3.50	0.350	0.275	57.738	89	251.325	P7AJ23	88	0.5

5.1.6 Dead Load (DL)

Dead load is automatically calculated by the software with the unit weight 25 kN/m^3

The weight of top and bottom blister, diaphragm are applied as load at their correct location

5.1.7 Super Imposed Dead Load (SIDL)

			Both side	Single Side
LOAD 1	Crash barrier	Weight per running metre	1.50 t/m	
LOAD 2	Wearing coat	Weight per running metre	1.97 t/m	
LOAD 3	Hand railing on footpath	Footpath Railing	1.23 t/m	
LOAD 4	Service load	Utility services @ 400 kg/m	1.00 t/m	0.5 t/m
LOAD 5	FPLL FULL SPAN	0.279	0.84 t/m	0.42 t/m
LOAD 6	FPLL SIDE SPAN		0.84 t/m	0.42 t/m
LOAD 7	FPLL CENTRAL SPAN		0.84 t/m	0.42 t/m
LOAD 8	FPLL FULL C/W	0.279	2.09 t/m	

5.1.8 Prestressing Load

It is directly incorporated in the software as per profile and sequences of stressing with all losses

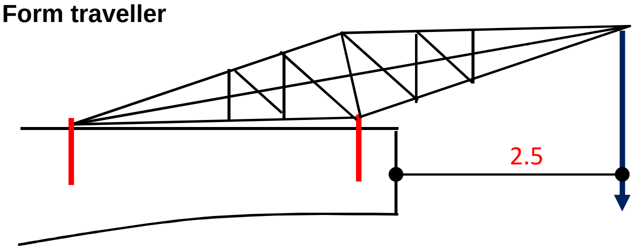
Top	1 Canti const. No.	34	19	T	15	378.5	x	2	=	757
cab for	2 Continuity No.	4	19	T	15	378.5	x	2	=	757
Seg	1 Central span No.	18	19	T	15	378.5	x	2	=	757
cab for	2 Side span No.	10	19	T	15	378.5	x	2	=	757

5.1.9 Creep & Shrinkage

For creep & shrinkage of conc, CEB-FIP design code is applied by program automatically with a humidity ratio 80%

5.1.10 Form Traveller& Wet Concrete

Form traveller



P = 500 kN

M = 1250 kNm

Wet Concrete : As per cross sectional area of segment x Segment length x Density 2.6 t/m^3

5.1.11 Live Load (LL)

Details of Live Loads Impact (Live Load)

(a) Class A two Lane	No. of trains	7 Trains x	2	Lane	=	8.8 %
(b) Class 70R wheeled	No. of trains	6 Trains x	1	Lane	=	8.8 %
(Single lane)	Eccen 1.155 m					

Footpath Live Load = 0.50 t/m^2

Intensity of load for longitudinal analysis 0.280 t/m^2

Congestion Factor as per IRC 6 - 2014 cl. 204.4 = 1.7

Frictional coefficient 0.05

5.1.12 Impact Factor (I)

As per clause 208.7 of IRC 6 - 2014, for calculating pressure on bearings full value of the appropriate impact % shall be allowed.

For the design of Piers, more than 3.0 m below, Impact % is Zero, However being an Integral structure full value of Impact is considered for the design of even piles also.

5.1.13 Longitudinal Force (LF)

Sadarghat bridge is an integral structure which has no bearing in intermediate piers. Therefore, longitudinal force and braking & accelerating forces are applied to different direction each other.

Hence longitudinal forces are applied separately as per IRC 6 -2014

5.1.14 Transverse Force due to Live Load (H & CF)

Since the entire length of the bridge is in no curve, hence no transverse force due to LL itself is considered

5.1.15 Wind Load on Structure (WS)

			HFL		LWL	
Wind Loads						
Basic wind speed Vz as per fig 6 IRC-6 : 2014		=	55		39.00	m/s
Height above the retarding surface			9.42	21.37	21.37	m
Wind speed at ht of above HFL	V_z	=	46.3	50.8	35.99	m/s
Horizontal wind pressure at the ht	P_z	=	1288	1545	776.6	N/m^2
		=	0.131	0.157	0.079	t/m^2

For DL and SIDL

G = 2

	Windward side			Leeward side		
Avg elevation Depth :	0.87 x	5.50 =	4.785	0 x	5.50 =	0.000
(Refer AutoCAD sketch)						
Height of crash barrier		=	1.150 m			0.000
Total projected depth for wind current		=	5.935			0.000
CG of box from top	2.000 m					

C_D = 1.499

F_T

			Windward side				For MIDAS			
			HFL	LWL						
Trans. wind force/m to be act at centroids		F_T	2.336	2.801	1.408	t/m	0.394	0.472	0.237	t/m^2
Longi force on superstructure	25%	F_L	0.584	0.700	0.352	t/m				
		C_L	0.75							
	F_V	t/m^2	0.1970	0.2362	0.1187					
For 12 m wide deck	F_V	t/m	2.363	2.834	1.425					

5.1.16 Wind Load on Vehicles (WL)

For LL	Height of crash barrier	=	1.925 m
	Acting at height above deck level		1.500 m
		C_D	1.200

	$F_{T\,LL}$	0.000	0.000	0.366	t/m
25%	$F_{V\,LL}$	0.000	0.000	0.091	t/m

Transverse wind force/m (@ 36 m/s) with LL 1.774 t/m

Transverse wind force/m (@ 50.8 m/s) without LL 2.801 t/m 58% Higher

Since wind intensity without LL is higher than with LL case, Hence without LL case has been considered in design

5.1.17 Overall Temperature (TU)

Uniform temperature

Bridge temperature range 5 to 40

Reference Temperature (Temperature Variation) ± 27.5 °C Say 35.0 °C

5.1.18 Differential Settlement (DS) 25 mm

5.1.19 **Barge Impact**

Design speed of unladen barge	6 knots	3.1 m/s
Design speed of laden barge	4 knots	2.1 m/s

Barge Collision Energy KE	500	x	C_H	x	W	x	V^2			
	500		1.05		200		4.41	=	463050	Nm

Barge damage Depth 91.941 mm

Barge collision Impact force 5516470
562.3 t

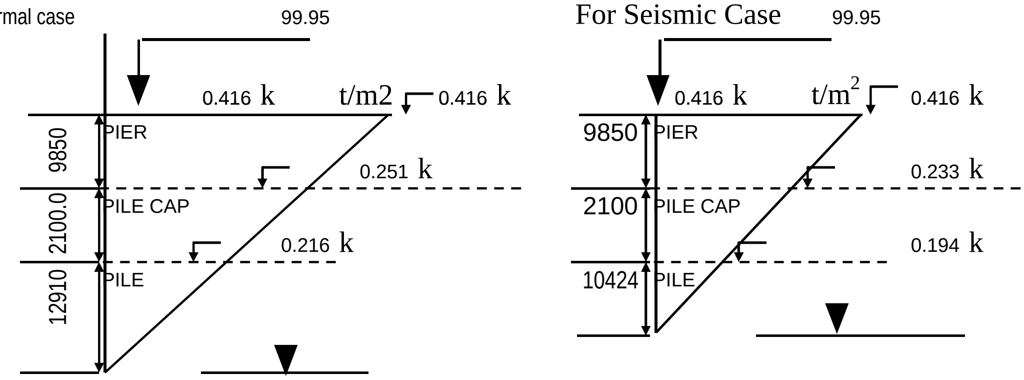
Restricting the impact up to 100% the force is 562.3 t
At height above bottom of pile cap 12 m

5.1.20 Water Current Pressure (WP)

Maximum surface velocity at H.F.L. = 2.83 m/sec

So, P = 52 kV^2 = 52 x k x 2.83^2
= 416 k kg/m^2 = 0.416 k t/m^2

For normal case 99.95 For Seismic Case 99.95



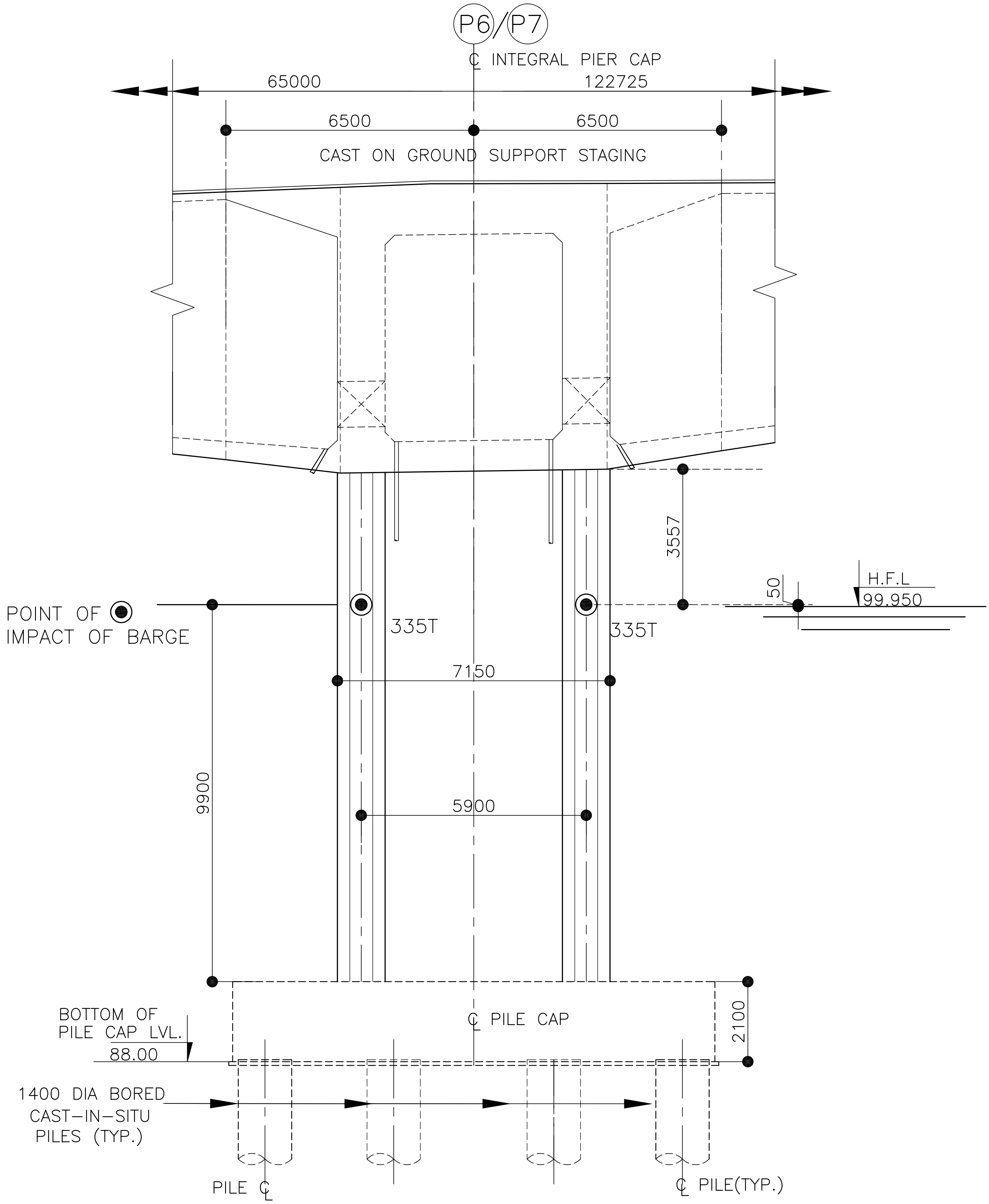
Calculation of water pressure in Transverse direction;

Pressure per metre depth

(a)	Pier	0.416	x (Cos 20^0 $)^2$ x	0.66	x	1.25	=	0.303	t/m	depth
		0.251	x (Cos 20^0 $)^2$ x	0.66	x	1.25	=	0.183	t/m	depth
(b)	Pile cap	0.251	x (Cos 20^0 $)^2$ x	1.50	x	12.65	=	4.208	t/m	depth
		0.216	x (Cos 20^0 $)^2$ x	1.50	x	12.65	=	3.620	t/m	depth
(c)	Pile	0.216	x (Cos 20^0 $)^2$ x	0.66	x	5.60	=	0.705	t/m	depth

Forces & moments due to water current at pile cap bottom;

								Force		LA		Trans Mt	
			0.183	x	9.85	=		1.802 t	x	7.025 m	=	12.66 t-m	
0.5	x	0.303	-	0.183	x	9.85	=	0.591 t	x	8.67 m	=	5.13 t-m	
			3.620	x	2.100	=		7.601 t	x	1.050 m	=	7.98 t-m	
0.5	x	4.208	-	3.620	x	2.100	=	0.618 t	x	1.400 m	=	0.87 t-m	
												10	
			0.705	x	12.91	=		9.102 t	x	8.607 m	=		
								19.72				36.63 t-m	



LONGITUDINAL ELEVATION

Calculation of water pressure in Longitudinal direction;

(a)	Pier	0.416	x (Sin 20^0)^2 x	0.66	x	5.50	=	0.177 t/m	depth
		0.251	x (Sin 20^0)^2 x	0.66	x	5.50	=	0.107 t/m	depth
(b)	Pile cap	0.251	x (Sin 20^0)^2 x	1.50	x	21.70	=	0.956 t/m	depth
		0.216	x (Sin 20^0)^2 x	1.50	x	21.70	=	0.823 t/m	depth
(c)	Pile	0.216	x (Sin 20^0)^2 x	0.66	x	5.60	=	0.093 t/m	depth

Calculation of force & moment due to water current at pile cap bottom;

				0.107	x	9.85	=	1.051 t	x	7.025 m	=	7.38 t-m
0.5	x	0.177	-	0.107	x	9.85	=	0.345 t	x	8.67 m	=	2.99 t-m
				0.823	x	2.100	=	1.727 t	x	1.050 m	=	1.81 t-m
0.5	x	0.956	-	0.823	x	2.100	=	0.140 t	x	1.400 m	=	0.20 t-m
								3.263				12.38

5.1.21 Seismic Load (EQ)

Response Spectrum   Ah = $\frac{Z/2 \times Sa/g}{R/I}$ Seismic Zone = V   Z = 0.36

I = 1.2

SEISMIC LOAD For Deformation

Longi R = 1   Trans R = 1

Time period in Longitudinal Direction (Sec)		1.290	Time period in Transverse Direction (Sec)		1.290
Sa/g (For hard soil, N>30)		0.775	Sa/g		0.775
Longitudinal seismic coefficient	1	**0.167**	Transverse seismic coefficient	1	**0.167**
Vertical L seismic coefficient		0.112	Vertical T seismic coefficient		0.112

SEISMIC LOAD for Bearing forces

Longi R = 2   Trans R = 2

Time period in Longitudinal Direction (Sec)		1.290	Time period in Transverse Direction (Sec)		1.290
Sa/g (For hard soil, N>30)		0.775	Sa/g		0.775
Longitudinal seismic coefficient	1	**0.084**	Transverse seismic coefficient	1	**0.084**
Vertical L seismic coefficient		0.056	Vertical T seismic coefficient		0.056

SEISMIC LOAD for Seismic stopper design

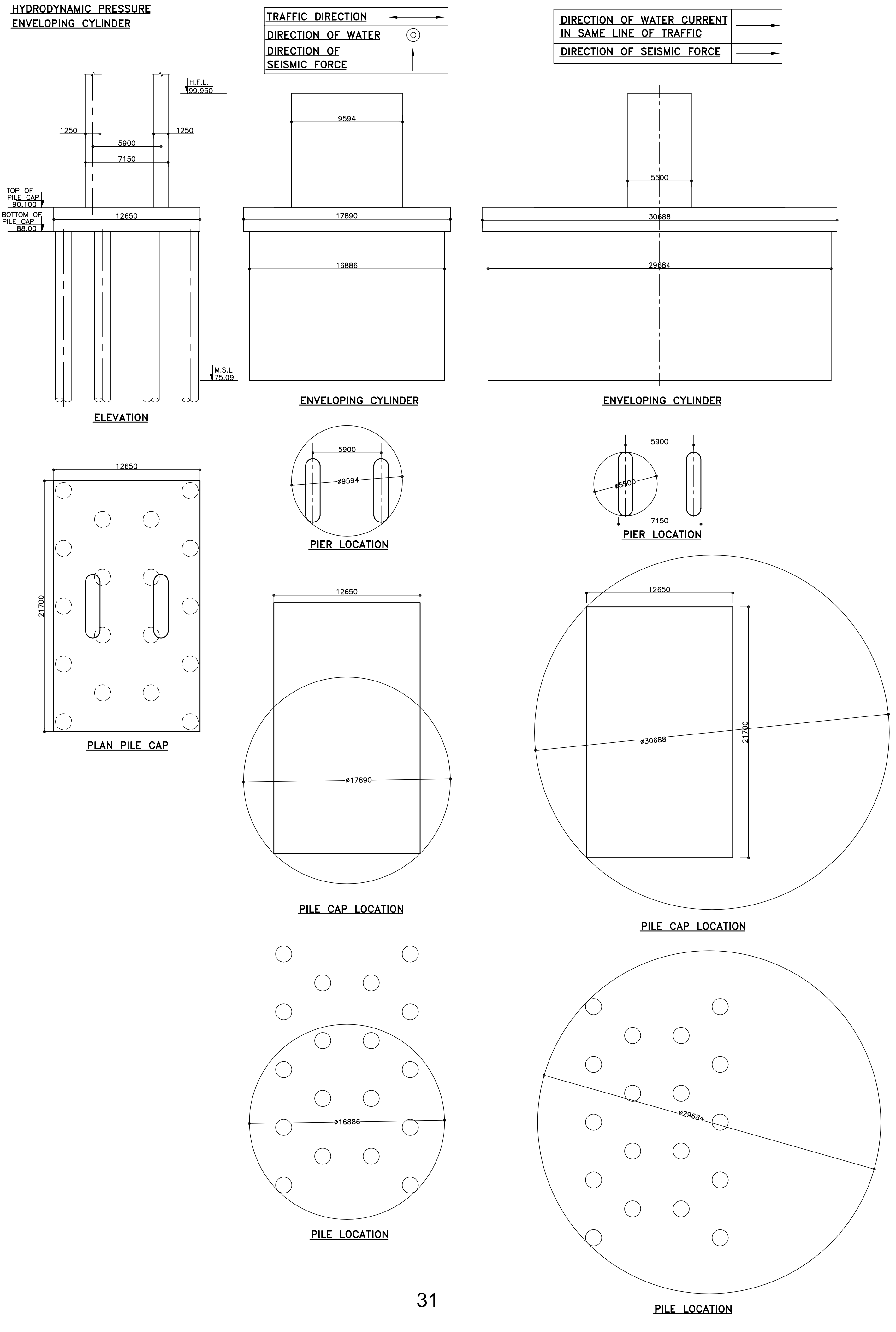
Longi R = 4   Trans R = 2.5

Time period in Longitudinal Direction (Sec)		1.290	Time period in Transverse Direction (Sec)		1.290
Sa/g (For hard soil, N>30)		0.775	Sa/g		0.775
Longitudinal seismic coefficient	1	**0.042**	Transverse seismic coefficient	1	**0.067**
Vertical L seismic coefficient		0.028	Vertical T seismic coefficient		0.045

Seismic case   Hydrodynamic Forces on Subdtructure F = $\mathbf{C_eA_hW_e}$

Transverse direction

Comp.	No.	Width	Submerged Height	R of Envelop cylinder	H/a	Ce	Force/m	Force	LA	Mt pile cap
1Pier	2	1.250	9.850	0.625	15.760	0.900	0.148	1.457	7.025	10.237
2Pile cap	1	1.250	2.100	0.625			0.148	0.311	1.050	0.326
	1	12.650	2.100	8.945	0.235	0.390	6.566	13.79	1.050	14.48
Forces up to bottom of pile cap								15.56		25.04
	1	21.400	10.424	9.433			0.148	1.542	5.212	8.038
	1	21.400	10.424	9.433			6.566	68.44	5.212	356.7
3Pile	1	21.400	10.424	9.433	1.105	0.486	9.090	94.75	5.212	493.84
							15.803			
Force per pile							0.878			


HYDRODYNAMIC PRESSURE
ENVELOPING CYLINDER
TRAFFIC DIRECTION
DIRECTION OF WATER
DIRECTION OF SEISMIC FORCE
DIRECTION OF WATER CURRENT IN SAME LINE OF TRAFFIC
DIRECTION OF SEISMIC FORCE
H.F.L. 99.950
1250
5900
7150
1250
TOP OF PILE CAP 90.100
BOTTOM OF PILE CAP 88.00
12650
M.S.L 75.09
ELEVATION
9594
17890
16886
ENVELOPING CYLINDER
5500
30688
29684
ENVELOPING CYLINDER
12650
21700
PLAN PILE CAP
5900
ø9594
PIER LOCATION
5900
ø5500
7150
PIER LOCATION
12650
ø17890
PILE CAP LOCATION
12650
ø30688
21700
PILE CAP LOCATION
ø16886
PILE LOCATION
ø29684
PILE LOCATION

Longitudinal direction

Comp.	No.	Width	Height	R of Env	H/a	Ce	Force/m	Force	LA	Mt p.cap
1Pier	1	5.500	9.850	2.750	3.582	0.900	0.895	8.817	7.025	61.936
	1	5.500	2.100	2.750			0.895	1.880	1.050	1.974
2Pile cap	1	21.700	2.100	15.344	0.137	0.390	12.076	25.359	1.050	26.627

	1	21.400	10.424	9.433			0.895	9.330	5.212	48.630
	1	21.400	10.424	9.433			12.076	125.88	5.212	656.06
3Pile	1	21.400	10.424	9.433	1.105	0.486	5.681	59.219	5.212	
							18.652	93.395		88.563
							1.036			

5.1.22 Calculation of BM in piles

Max P 498 Min P -46 HF 33

Pile Ht below cap	2nd order Eccen. Global	BM/ Unit HF	Mt due to HF	Def.Coeffi ./HF cm	1st order Eccen.	2nd order Eccen. Local	Pile Ld	Mt 2nd odr effect Max P	Gross Load	Total BM	Mt 2nd odr effect Min P	BM Due to Hydeodynamic force	Gross Load	Total BM
0	0.348	0	0	0.097	0.032	0	0	16	498	15.89	-1.5	155.9	-46	154.5
1	0.346	0	0	0.096	0.032	0.002	2.16	17	500.9	16.52	-1.5	152.3	-43	150.8
2	0.341	0	0	0.093	0.031	0.006	4.31	18	503.8	18.44	-1.7	145.1	-41	143.4
3	0.334	0	0	0.089	0.029	0.014	6.47	22	506.7	21.57	-1.9	134.3	-39	132.4
4	0.324	0	0	0.084	0.028	0.024	8.62	26	509.7	25.89	-2.3	119.9	-37	117.6
5	0.311	0	0	0.078	0.026	0.037	10.78	31	512.6	31.35	-2.6	101.8	-35	99.2
6	0.296	0	0	0.071	0.023	0.052	12.93	38	515.5	37.89	-3.1	80.17	-33	77.1
7	0.279	0	0	0.064	0.021	0.069	15.09	45	518.4	45.47	-3.6	54.92	-30	51.3
8	0.259	0	0	0.056	0.018	0.088	17.24	54	521.3	54.05	-4.1	26.06	-28	22.0
9	0.239	0	0	0.048	0.016	0.109	19.40	64	524.2	63.56	-4.6	6.41	-26	1.8
10	0.216	0	0	0.04	0.013	0.132	21.55	74	527.1	73.99	-5.2	42.48	-24	37.3
11	0.192	0	0	0.032	0.011	0.155	23.71	85	530.0	85.25	-5.7	82.17	-22	76.4
12	0.167	0	0	0.025	0.008	0.181	25.86	97	532.9	97.27	-6.3	125.5	-20	119.2
13	0.141	0	0	0.019	0.006	0.207	28.02	110	535.8	110	-6.8	138.1	-18	131.3
14	0.114	0	0	0.013	0.004	0.234	30.17	123	538.7	123.5	-7.3	134.3	-15	127.0
15	0.086	0	0	0.009	0.003	0.262	32.33	138	541.7	137.5	-7.8	119	-13	111.1
16	0.057	0	0	0.005	0.002	0.29	34.48	152	544.6	152.1	-8.3	96.95	-11	88.7
17	0.029	0	0	0.002	7E-04	0.319	36.64	167	547.5	167	-8.7	73.29	-9	64.6
18	0	0	0	2E-04	7E-05	0.348	38.79	182	550.4	182.2	-9.1	50.89	-7	41.8
19	-0.04	0	0	-0	-0	0.383	40.95	201	553.3	201.2	-9.6	31.63	-5	22.0

5.2 Design of foundation and Substructure

5.2.1 Forces on single Pile

N	ZL	ZT
18	61.194	75

S.No.	Load		P	F_T	F_L	T	M_L	M_T	Max P	Min P	HF
		Ld fac	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)			
1	SIDL-CB		-404.31	0	38.56	0	1346.59	0	44		3
2	SIDL-WC		-212.86	0	19.98	0	699.7	0	23		2
3	TU(+) Temperature Uniform		12.7	0	145.92	0	-2082.26	0			
4	TU(-)		-12.7	0	-145.92	0	2082.26	0			
5	TG(+) Temperature gradient		26.53	0	26.16	0	313.97	0			
6	TG(-)		-6.2	0	-17.99	0	99.29	0			
7	BRAKING		1.77	0	-44.1	0	469.28	0	8		3
8	WIND(LONG.+X)		1.34	0	-84.39	0	869.51	0	14		5
9	WIND(TRANS.+Y)		0	-293.82	0	335.46	0	6017.44	80		17
10	WIND(VERT.+Z)		310.01	0	-29.57	0	-1032.58	0	34		2
11	FPLL1		-33.6	0.12	3.2	1.79	111.92	142.94	6		1
12	FPLL2		-33.6	-0.1	3.2	-1.78	111.92	-139.99	6		1
13	BARGE IMPACT		4.74	-538.07	-136.91	-141	209.06	4539.65			
14	WATER CURRENT		0.01	-3.83	-2.63	2.1	10.02	24.51	0		1
15	HYDRODYNAMIC FORCE		0.06	-1.09	-20.34	0.59	71.26	6.57	1		2
16	BUYOANCY		704.59	0	-0.34	0	-17.63	0			
17	XX(RS) Seismic		46.63	0	847.83	0	9000.64	0	150		48
18	YY(RS) Seismic		0	767.87	0.01	1242.35	0.03	13818.91	184		43
19	ZZ(RS) Seismic		622.37	0	74.92	0	4076.36	0	101		5
									37.4		12.0
									73.7		17.2
									40.5		2.0
									97.1		21.4
20	CLASS A(L1)(max)		2.4	0.65	25	2.32	1097.58	0			
21	CLASS A(L2)(max)		2.4	0.42	25	2.94	1097.58	139.3			
22	CLASS 70R(L1)(max)		3.99	0.49	39.26	2	1704.24	0			
23	CLASS A(L1)(min)		-156	-0.98	-11.26	-6.87	-625.72	-325.04			
24	CLASS A(L2)(min)		-156	-0.28	-11.26	-0.99	-625.72	0			
25	CLASS 70R(L1)(min)		-242.93	-0.72	-18.12	-5.23	-978.39	-237.46			
26	CLASS A(L1)(all)		-156	-0.98	25	-6.87	1097.58	-325.04			
27	CLASS A(L2)(all)		-156	0.42	25	2.94	1097.58	139.3			
28	CLASS 70R(L1)(all)		-242.93	-0.72	39.26	-5.23	1704.24	-237.46	45		3
29	SLC(max)		32.78	0	12.73	0	669.39	0			
30	SLC(min)		-32.78	0	-12.73	0	-669.39	0			
31	SLC(all)		32.78	0	12.73	0	669.39	0			
32	DL		-4345	0	-16.24	0	3134.84	0	293		1
33	TEND_Primary		0	0	0	0	0	0	0		0
34	TEND_Secondary		40.32	0	-156.88	0	-619.64	0	12		9
35	TEND_PS (Pri+Sec)		40.32	0	-156.88	0	-619.64	0	12		9
36	CS_S Creep Shrinkage		-19.22	0	-208.68	0	2497.98	0			
	Pile load Normal Case								443		31
	Pile load Wind Case								482		42
	Pile load Seismic Case								445		36

S.No.	Load	Ld fac	P Axial (tonf)	F_T Shear-y (tonf)	F_L Shear-z (tonf)	T Torsion (tonf·m)	M_L Moment-y (tonf·m)	M_T Moment-z (tonf·m)	Max P	Min P	HF
37	ULS-Base cb2(36)(max)		-6540.52	221.92	117.46	260.56	10458.08	4860.47	599	128	14
38	ULS-Base cb2(55)(max)		-6276.73	-440.73	-174.02	503.18	9507.9	9026.16	624	73	27
39	ULS-Accid cb(max)		-4936.85	539.08	103.06	146.85	7171.21	4766.2	455	94	31
40	ULS-EQ-X1.0(PILE)(max)		-4113.14	108.25	314.57	176.27	9976.32	2003.7	418	39	19
41	ULS-EQ-Y1.0(PILE)(max)		-4072	576.18	114.24	933.33	8126.38	10424.6	498	-46	33
42	ULS-EQ-Z1.0(PILE)(max)		-3904.34	115.45	71.24	187.91	8572.32	2133.25	385	48	8
43	ULS-EQ-X1.35(PILE)(max)		-6554.49	108.25	329.71	176.27	11807.35	2003.7	584	144	20
44	ULS-EQ-Y1.35(PILE)(max)		-6513.34	576.18	129.38	933.33	9957.4	10424.6	664	60	33
45	ULS-EQ-Z1.35(PILE)(max)		-6345.69	115.45	86.38	187.91	10403.34	2133.25	551	154	9
46	ULS-EQ-CBS-(PILE)(max)		-3904.34	576.18	329.71	933.33	11807.35	10424.6			
47	ULS-Basic CB1(DL-1)(max)		-4681.14	-262.42	-2.47	313.61	11074.7	5868.81	519	1	15
48	ULS-BaseCB2(36,DL-1)(max)		-4485.11	-439.19	-73.03	512.15	11095.65	9373.54	555	-57	25
49	ULS-BaseCB2(55,DL-1)(max)		-4454.82	-440.73	-196.82	503.18	7414.63	9026.16	489	6	27
50	ULS-Base cb2(36)(min)		-7466.47	-222.13	-253.86	-263.97	4477.4	-5101.1	556	274	19
51	ULS-Base cb2(55)(min)		-7206.76	-440.73	-262.72	503.18	6410.15	9026.16	625	175	29
52	ULS-Accid cb(min)		-5245.64	-539.22	-301.46	-149.07	3012.18	-4923.14	406	177	35
53	ULS-EQ-X1.0(PILE)(min)		-4411.71	-108.29	-536.2	-176.86	-605.84	-2045.55	282	208	31
54	ULS-EQ-Y1.0(PILE)(min)		-4452.86	-576.21	-335.87	-933.92	1244.11	-10466.45	407	87	38
55	ULS-EQ-Z1.0(PILE)(min)		-4620.51	-115.49	-292.88	-188.51	798.17	-2175.1	299	215	18
56	ULS-EQ-X1.35(PILE)(min)		-6853.06	-108.29	-521.06	-176.86	1225.19	-2045.55	428	333	30
57	ULS-EQ-Y1.35(PILE)(min)		-6894.21	-576.21	-320.73	-933.92	3075.13	-10466.45	573	193	37
58	ULS-EQ-Z1.35(PILE)(min)		-7061.86	-115.49	-277.74	-188.51	2629.2	-2175.1	464	320	17
59	ULS-EQ-CBS-(PILE)(min)		-7061.86	-576.21	-536.2	-933.92	-605.84	-10466.45			
60	ULS-Basic CB1(DL-1)(min)		-5837.76	-266.74	-317.06	285.76	1734.21	4648.72	415	234	24
61	ULS-BaseCB2(36,DL-1)(min)		-5874.07	-442.5	-362.12	490.8	2261.82	8438.14	476	177	32
62	ULS-BaseCB2(55,DL-1)(min)		-5384.86	-440.73	-285.52	503.18	4316.88	9026.16	490	108	30
63	ULS-Base cb2(36)(all)		-7466.47	-222.13	-253.86	-263.97	10458.08	-5101.1	654	176	19
64	ULS-Base cb2(55)(all)		-7206.76	-440.73	-262.72	503.18	9507.9	9026.16	676	125	29
65	ULS-Accid cb(all)		-5245.64	-539.22	-301.46	-149.07	7171.21	-4923.14	474	109	35
66	ULS-EQ-X1.0(PILE)(all)		-4411.71	-108.29	-536.2	-176.86	9976.32	-2045.55	435	55	31
67	ULS-EQ-Y1.0(PILE)(all)		-4452.86	-576.21	-335.87	-933.92	8126.38	-10466.45	520	-25	38
68	ULS-EQ-Z1.0(PILE)(all)		-4620.51	-115.49	-292.88	-188.51	8572.32	-2175.1	426	88	18
69	ULS-EQ-X1.35(PILE)(all)		-6853.06	-108.29	-521.06	-176.86	11807.35	-2045.55	601	161	30
70	ULS-EQ-Y1.35(PILE)(all)		-6894.21	-576.21	-320.73	-933.92	9957.4	-10466.45	685	81	37
71	ULS-EQ-Z1.35(PILE)(all)		-7061.86	-115.49	-277.74	-188.51	10403.34	-2175.1	591	193	17
72	ULS-EQ-CBS-(PILE)(all)		-7061.86	-576.21	-536.2	-933.92	11807.35	-10466.45			
73	ULS-Basic CB1(DL-1)(all)		-5837.76	-266.74	-317.06	313.61	11074.7	5868.81	584	65	24
74	ULS-BaseCB2(36,DL-1)(all)		-5874.07	-442.5	-362.12	512.15	11095.65	9373.54	633	20	32
75	ULS-BaseCB2(55,DL-1)(all)		-5384.86	-440.73	-285.52	503.18	7414.63	9026.16	541	58	30

5.2.2 SECTION CHECK OF PILE DIA 1400 MM

Section 1 Details

1.62% reinforcement in section 1 (Pile Sec1). Check this against code requirements.

ULS Cases Analysed

Name	Loading	Pre-stress Factor
ULS Case 1	L1	1.000
ULS Case 2	L2	1.000

Strength Analysis - Loads

Case	N [kN]	Myy [kNm]	Mzz [kNm]	M [kNm]	θ [°]
1	5000.	4400.	0.0	4400.	0.0
2	-460.0	4400.	0.0	4400.	0.0

Strength Analysis - Summary

Governing conditions are defined as:

A - reinforcing steel tension strain limit

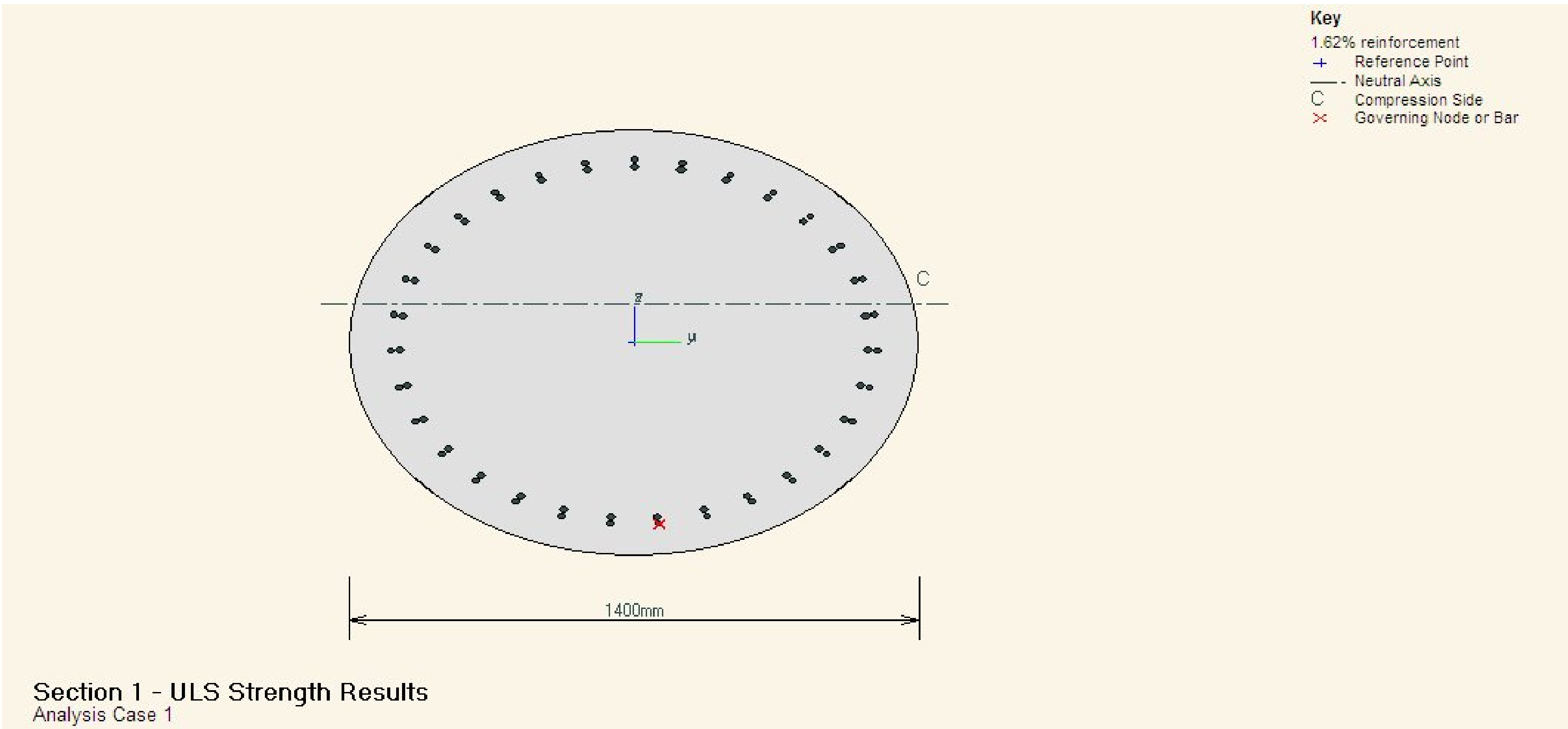
B - concrete compression strain limit

C - concrete pure compression strain limit

IS 456 Section 39.1

Effective centroid is reported relative to the reference point.

Case	Eff. Centroid (y)	Eff. Centroid (z)	N [kN]	M [kNm]	Mu [kNm]	M/Mu	Governing Condition	Neutral Axis Angle [°]	Neutral Axis Depth [mm]
1	1.677E-6	801.4E-9	5000.	4400.	6429.	0.6844	A: Bar 16	0.0	572.5
2	6.645E-6	16.12E-6	-460.0	4400.	4640.	0.9483	A: Bar 17	0.0	426.9
Maxima									
2	6.645E-6	16.12E-6	-460.0	4400.	4640.	0.9483	A: Bar 17		
Minima									
1	1.677E-6	801.4E-9	5000.	4400.	6429.	0.6844	A: Bar 16		


Key
1.62% reinforcement
Reference Point
Neutral Axis
Compression Side
Governing Node or Bar
C
z
y
1400mm
Section 1 - ULS Strength Results
Analysis Case 1

5.2.3 Design of Substructure Pier

S.No.	Load	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)
		P	F_T	F_L	T	M_L	M_T	P	F_T	F_L	T	M_L	M_T
	Load case / Comb	200	P6 Top					210	P7 Top				
1	SIDL-CB	77.05	0	13.72	0	93.92	0	-481.36	0	24.84	0	174.36	0
2	SIDL-WC	38.58	0	7.07	0	48.44	0	-251.44	0	12.91	0	90.65	0
3	TU(+) Temperature Uniform	-147.56	0	86.03	0	503.66	0	160.26	0	59.89	0	346.56	0
4	TU(-)	147.56	0	-86.03	0	-503.66	0	-160.26	0	-59.89	0	-346.56	0
5	TG(+) Temperature Gradient	101.62	0	12.48	0	78.58	0	-75.08	0	13.68	0	89.36	0
6	TG(-)	-10.72	0	-8.94	0	-52.67	0	4.52	0	-9.05	0	-55.68	0
7	BRAKING	20.08	0	-22.04	0	-129.65	0	-18.31	0	-22.06	0	-129.8	0
8	WIND(LONG.+X)	32.62	0	-42.19	0	-248.59	0	-31.28	0	-42.2	0	-248.64	0
9	WIND(TRANS.+Y)	0	-100.92	0	29.04	0	1158.08	0	-192.9	0	39.67	0	735.05
10	WIND(VERT.+Z)	-59.1	0	-10.52	0	-72.02	0	369.11	0	-19.05	0	-133.7	0
11	FPLL1	6.41	0.24	1.14	0.38	7.81	71.47	-40.01	-0.12	2.06	0.36	14.49	73.13
12	FPLL2	6.41	-0.23	1.14	-0.39	7.81	-69.79	-40.01	0.13	2.06	-0.37	14.49	-71.55
13	BARGE IMPACT	-125.41	314.45	135	74.96	134.58	208.72	130.15	-222.53	-41.91	53.8	-257.8	-897.97
14	WATER CURRENT	-0.84	0.36	0	0.24	-1.76	0.78	0.85	-0.21	0	0.19	-1.76	-2.11
15	HYDRODYNAMIC FORCE	-6.65	0.1	0	0.07	-11.57	0.23	6.71	-0.06	0	0.05	-11.57	-0.59
16	BUYOANCY	-3.63	0	-0.19	0	-1.38	0	3.22	0	-0.15	0	-1.09	0
17	XX(RS)	654.76	0	370.61	0	2223.88	0	626.77	0	370.71	0	2224.19	0
18	YY(RS)	0	196.62	0	100.59	0.01	2810.02	0	493.45	0	133.65	0	1342.92
19	ZZ(RS)	789.32	0	106.28	0	629.3	0	816.37	0	105.42	0	623.62	0
20	CLASS A(L1)(max)	172.08	0.78	10.97	1.12	77.62	0	85.78	1.36	14.03	1.21	99.93	0
21	CLASS A(L2)(max)	172.08	0.66	10.97	0.82	77.62	71.34	85.78	0.48	14.03	0.81	99.93	69.85
22	CLASS 70R(L1)(max)	269.81	0.62	17.38	0.85	122.04	0	154.08	1.03	21.88	0.92	154.75	0
23	CLASS A(L1)(min)	-155.23	-1.54	-6.22	-1.91	-45.21	-166.46	-270.29	-1.13	-5.04	-1.89	-36.85	-162.99
24	CLASS A(L2)(min)	-155.23	-0.33	-6.22	-0.48	-45.21	0	-270.29	-0.58	-5.04	-0.52	-36.85	0
25	CLASS 70R(L1)(min)	-234.45	-1.2	-10.05	-1.51	-73.26	-122.56	-422.34	-0.97	-8.07	-1.47	-59.16	-123.44
26	CLASS A(L1)(all)	172.08	-1.54	10.97	-1.91	77.62	-166.46	-270.29	1.36	14.03	-1.89	99.93	-162.99
27	CLASS A(L2)(all)	172.08	0.66	10.97	0.82	77.62	71.34	-270.29	-0.58	14.03	0.81	99.93	69.85
28	CLASS 70R(L1)(all)	269.81	-1.2	17.38	-1.51	122.04	-122.56	-422.34	1.03	21.88	-1.47	154.75	-123.44
29	SLC(max)	137.66	0	7.12	0	52.24	0	122.08	0	5.6	0	41.41	0
30	SLC(min)	-137.66	0	-7.12	0	-52.24	0	-122.08	0	-5.6	0	-41.41	0
31	SLC(all)	137.66	0	7.12	0	52.24	0	122.08	0	5.6	0	41.41	0
32	DL	-1103.2	0	-60.16	0	-385.09	0	-2116.5	0	43.92	0	365.97	0
33	TEND_P	0	0	0	0	0	0	0	0	0	0	0	0
34	TEND_S	-296.26	0	-30.15	0	-130.97	0	336.59	0	-126.73	0	-861.12	0
35	TEND_PS	-296.26	0	-30.15	0	-130.97	0	336.59	0	-126.73	0	-861.12	0
36	CS_S	131.99	0	-112.7	0	-671.08	0	-151.21	0	-95.98	0	-571.81	0
37	EQ_xx(E)(max)	654.76	0	370.61	0	2223.88	0	626.77	0	370.71	0	2224.19	0
38	EQ_yy(E)(max)	0	196.62	0	100.59	0.01	2810.02	0	493.45	0	133.65	0	1342.92
39	EQ_zz(E)(max)	789.32	0	106.28	0	629.3	0	816.37	0	105.42	0	623.62	0

5.2.3 Design of Substructure Pier

S.No.	Load	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)
		P	F_T	F_L	T	M_L	M_T	P	F_T	F_L	T	M_L	M_T
	Load case / Comb	200	P6 Top					210	P7 Top				
40	ULS-Base cb2(36)(max)	-1104.2	77.86	15.85	24.77	172.17	1044.48	-3156.8	147.25	101.62	32.82	758.89	727.16
41	ULS-Base cb2(55)(max)	-1476.4	-151.38	-127.98	43.56	-704.14	1737.12	-3103.9	-289.35	-46.04	59.51	-145.45	1102.58
42	ULS-Accid cb(max)	-838.84	315.87	102.51	76.91	2.83	323.45	-2251.9	224.2	40.54	55.8	317.99	1012.67
43	ULS-EQ-X(PIER)(max)	-1270.2	17.48	46.13	9.27	324.91	275.07	-3322.9	43.38	117.01	12.16	803.65	147.42
44	ULS-EQ-Y(PIER)(max)	-1320.8	94.76	-1.92	48.8	36.09	1379.41	-3367.9	237.3	68.9	64.68	514.47	675.19
45	ULS-EQ-Z(PIER)(max)	-1233.1	18.07	-5.36	9.57	14.17	283.5	-3274.4	44.86	65.33	12.56	491.65	151.45
46	ULS-CBS(PIER)(max)	-838.84	315.87	102.51	76.91	324.91	1737.12	-2251.9	237.3	117.01	64.68	803.65	1102.58
47	LCB70(max)	137.66	0	7.12	0	52.24	0	122.08	0	5.6	0	41.41	0
48	ULS-Basic CB1(DL-1)(max)	-562.16	-88	-23.95	30.03	-48.71	1271.73	-1947.3	-170.26	21.49	39.7	247.07	890.95
49	ULS-BaseCB2(36,DL-1)(max)	-656.25	-149.21	-60.24	46.55	-267.56	1913.04	-1805.6	-286.78	-12.8	62.57	42.62	1278.45
50	ULS-BaseCB2(55,DL-1)(max)	-1146.2	-151.38	-117.02	43.56	-638.55	1737.12	-2006	-289.35	-79.79	59.51	-402.55	1102.58
51	EQ_xx(E)(min)	-654.76	0	-370.61	0	-2223.9	0	-626.77	0	-370.71	0	-2224.2	0
52	EQ_yy(E)(min)	0	-196.62	0	-100.59	-0.01	-2810	0	-493.45	0	-133.65	0	-1342.9
53	EQ_zz(E)(min)	-789.32	0	-106.28	0	-629.3	0	-816.37	0	-105.42	0	-623.62	0
54	ULS-Base cb2(36)(min)	-2057.4	-78.41	-160.37	-25.37	-938.67	-1167.5	-4687.2	-147.06	-93.49	-33.34	-489.21	-847.71
55	ULS-Base cb2(55)(min)	-1653.7	-151.38	-159.54	43.56	-920.21	1737.12	-4211.2	-289.35	-103.18	59.51	-546.55	1102.58
56	ULS-Accid cb(min)	-1685.4	-316.23	-230.85	-77.3	-677.15	-403.69	-3179.8	-224.08	-110.61	-56.14	-637.56	-1091.3
57	ULS-EQ-X(PIER)(min)	-1946.2	-17.58	-204.22	-9.38	-1184	-296.46	-4006.6	-43.35	-134.29	-12.25	-712.21	-168.38
58	ULS-EQ-Y(PIER)(min)	-1895.6	-94.85	-156.17	-48.91	-895.18	-1400.8	-3961.6	-237.27	-86.18	-64.78	-423.02	-696.15
59	ULS-EQ-Z(PIER)(min)	-1983.4	-18.17	-152.73	-9.68	-873.26	-304.89	-4055.1	-44.83	-82.61	-12.65	-400.2	-172.41
60	ULS-CBS(PIER)(min)	-2190.3	-316.23	-230.85	-77.3	-1184	-1400.8	-5044.8	-289.35	-134.29	-64.78	-712.21	-1091.3
61	LCB70(min)	-137.66	0	-7.12	0	-52.24	0	-122.08	0	-5.6	0	-41.41	0
62	ULS-Basic CB1(DL-1)(min)	-1860.1	-94.38	-169.61	21.45	-999.99	652.35	-3946.9	-176.72	-147.45	31.02	-873.49	274.92
63	ULS-BaseCB2(36,DL-1)(min)	-1747.1	-154.11	-188.95	39.97	-1113.6	1438.18	-3936.6	-291.74	-173.17	55.92	-1033.1	806.16
64	ULS-BaseCB2(55,DL-1)(min)	-1323.5	-151.38	-148.58	43.56	-854.63	1737.12	-3113.3	-289.35	-136.93	59.51	-803.66	1102.58
65	EQ_xx(E)(all)	654.76	0	370.61	0	2223.88	0	626.77	0	370.71	0	2224.19	0
66	EQ_yy(E)(all)	0	196.62	0	100.59	0.01	2810.02	0	493.45	0	133.65	0	1342.92
67	EQ_zz(E)(all)	789.32	0	106.28	0	629.3	0	816.37	0	105.42	0	623.62	0
68	ULS-Base cb2(36)(all)	-2057.4	-78.41	-160.37	-25.37	-938.67	-1167.5	-4687.2	147.25	101.62	-33.34	758.89	-847.71
69	ULS-Base cb2(55)(all)	-1653.7	-151.38	-159.54	43.56	-920.21	1737.12	-4211.2	-289.35	-103.18	59.51	-546.55	1102.58
70	ULS-Accid cb(all)	-1685.4	-316.23	-230.85	-77.3	-677.15	-403.69	-3179.8	224.2	-110.61	-56.14	-637.56	-1091.3
71	ULS-EQ-X(PIER)(all)	-1946.2	-17.58	-204.22	-9.38	-1184	-296.46	-4006.6	43.38	-134.29	-12.25	803.65	-168.38
72	ULS-EQ-Y(PIER)(all)	-1895.6	-94.85	-156.17	-48.91	-895.18	-1400.8	-3961.6	237.3	-86.18	-64.78	514.47	-696.15
73	ULS-EQ-Z(PIER)(all)	-1983.4	-18.17	-152.73	-9.68	-873.26	-304.89	-4055.1	44.86	-82.61	-12.65	491.65	-172.41
74	ULS-CBS(PIER)(all)	-2190.3	-316.23	-230.85	-77.3	-1184	1737.12	-5044.8	-289.35	-134.29	-64.78	803.65	1102.58
75	LCB70(all)	137.66	0	7.12	0	52.24	0	122.08	0	5.6	0	41.41	0
76	ULS-Basic CB1(DL-1)(all)	-1860.1	-94.38	-169.61	30.03	-999.99	1271.73	-3946.9	-176.72	-147.45	39.7	-873.49	890.95
77	ULS-BaseCB2(36,DL-1)(all)	-1747.1	-154.11	-188.95	46.55	-1113.6	1913.04	-3936.6	-291.74	-173.17	62.57	-1033.1	1278.45
78	ULS-BaseCB2(55,DL-1)(all)	-1323.5	-151.38	-148.58	43.56	-854.63	1737.12	-3113.3	-289.35	-136.93	59.51	-803.66	1102.58

5.2.3 Design of Substructure Pier

S. No.	Load	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)
		P	F_T	F_L	T	M_L	M_T	P	F_T	F_L	T	M_L	M_T
	Load case / Comb	200	P6 Top					210	P7 Top				
79	ULS-EQ-X(PIER)(max)	-1270.2	17.48	46.13	9.27	324.91	275.07	-3322.9	43.38	117.01	12.16	803.65	147.42
80	ULS-EQ-Y(PIER)(max)	-1398.8	59.36	-27.68	30.7	-117.98	873.6	-3445.9	148.48	43.19	40.63	360.69	433.46
81	ULS-EQ-Z(PIER)(max)	-1233.1	18.07	-5.36	9.57	14.17	283.5	-3274.4	44.86	65.33	12.56	491.65	151.45
82	ULS-CBS(PIER)(max)	-838.84	315.87	102.51	76.91	412.63	1913.04	-2251.9	291.92	147.55	62.57	1045.65	1278.45
83	ULS-EQ-X(PIER)(min)	-1946.2	-17.58	-204.22	-9.38	-1184	-296.46	-4006.6	-43.35	-134.29	-12.25	-712.21	-168.38
84	ULS-EQ-Y(PIER)(min)	-1817.6	-59.46	-130.41	-30.8	-741.11	-895	-3883.7	-148.45	-60.47	-40.72	-269.24	-454.43
85	ULS-EQ-Z(PIER)(min)	-1983.4	-18.17	-152.73	-9.68	-873.26	-304.89	-4055.1	-44.83	-82.61	-12.65	-400.2	-172.41
86	ULS-CBS(PIER)(min)	-2190.3	-316.23	-230.85	-77.3	-1184	-2036.1	-4988.5	-291.74	-139.42	-63.09	-775.97	-1399
87	ULS-EQ-X(PIER)(all)	-1946.2	-17.58	-204.22	-9.38	-1184	-296.46	-4006.6	43.38	-134.29	-12.25	803.65	-168.38
88	ULS-EQ-Y(PIER)(all)	-1817.6	-59.46	-130.41	-30.8	-741.11	-895	-3883.7	148.48	-60.47	-40.72	360.69	-454.43
89	ULS-EQ-Z(PIER)(all)	-1983.4	-18.17	-152.73	-9.68	-873.26	-304.89	-4055.1	44.86	-82.61	-12.65	491.65	-172.41
90	ULS-CBS(PIER)(all)	-2190.3	-316.23	-230.85	-77.3	-1184	-2036.1	-4988.5	291.92	147.55	-63.09	1045.65	-1399
91	SLS-RARE-CBS(max)	-408.95	1.88	-36.54	30.99	-155.25	1272.81	-2039.7	2.23	-5.51	41.67	51.83	849.75
92	SLS-FREQ-CBS(max)	-540.38	1.41	-85.79	17.94	-446.37	725.44	-2208.6	1.68	-42.29	24.34	-166.13	482.23
93	SLS-RARE-CBS(min)	-1782.4	-102.7	-313.66	-3.12	-1835.3	-259.95	-3775.8	-194.46	-251.89	-3.12	-1481.3	-257.75
94	SLS-FREQ-CBS(min)	-1674.5	-61.03	-266.18	-2.34	-1557.2	-194.96	-3556.8	-116.16	-217.42	-2.34	-1280.2	-193.32
95	SLS-RARE-CBS(all)	-1782.4	-102.7	-313.66	30.99	-1835.3	1272.81	-3775.8	-194.46	-251.89	41.67	-1481.3	849.75
96	SLS-FREQ-CBS(all)	-1674.5	-61.03	-266.18	17.94	-1557.2	725.44	-3556.8	-116.16	-217.42	24.34	-1280.2	482.23
97	SLS SEISMIC-X COMB(max)	-708.63	23.58	-13.55	12.6	-26.83	416.55	-2321.2	58.28	30.82	16.45	239.06	246.22
98	SLS SEISMIC-Y COMB(max)	-883.05	79.22	-113.3	41.06	-625.39	1211.78	-2487.9	197.93	-68.95	54.28	-359.6	626.26
99	SLS SEISMIC-Z COMB(max)	-662.04	24.17	-83.54	12.9	-449.19	424.98	-2259.3	59.76	-39.43	16.85	-184.99	250.25
100	SLS SEISMIC-X COMB(min)	-1568	-23.66	-345.31	-12.71	-2024.5	-436.59	-3211.1	-58.24	-302.6	-16.55	-1770.7	-265.91
101	SLS SEISMIC-Y COMB(min)	-1393.6	-79.3	-245.56	-41.17	-1426	-1231.8	-3044.3	-197.89	-202.83	-54.38	-1172	-645.96
102	SLS SEISMIC-Z COMB(min)	-1614.6	-24.25	-275.32	-13.01	-1602.2	-445.03	-3272.9	-59.73	-232.35	-16.96	-1346.6	-269.94
103	SLS SEISMIC-X COMB(all)	-1568	-23.66	-345.31	-12.71	-2024.5	-436.59	-3211.1	58.28	-302.6	-16.55	-1770.7	-265.91
104	SLS SEISMIC-Y COMB(all)	-1393.6	-79.3	-245.56	-41.17	-1426	-1231.8	-3044.3	197.93	-202.83	-54.38	-1172	-645.96
105	SLS SEISMIC-Z COMB(all)	-1614.6	-24.25	-275.32	-13.01	-1602.2	-445.03	-3272.9	59.76	-232.35	-16.96	-1346.6	-269.94

5.2.3

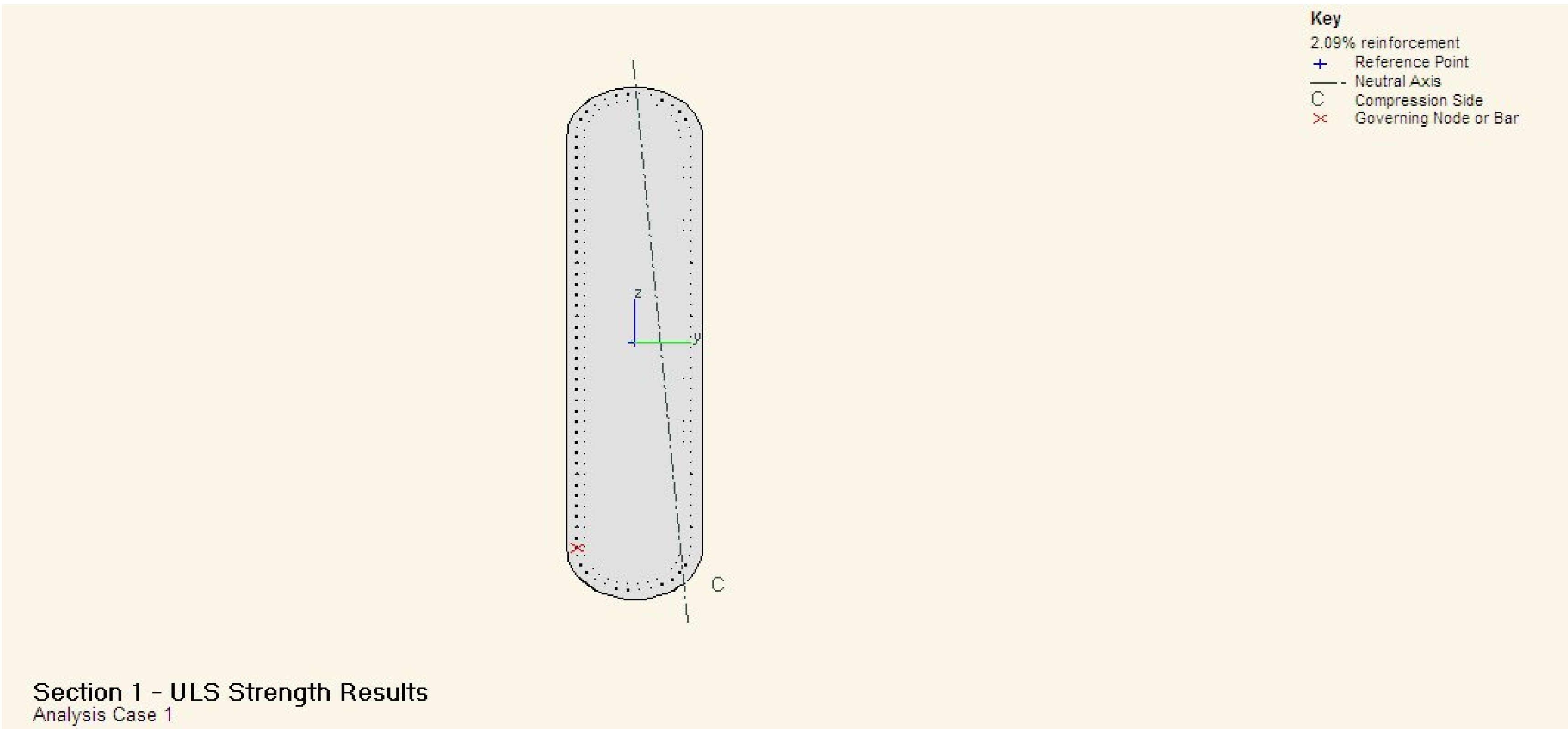
S. No.	Load	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)
		P	F_T	F_L	T	M_L	M_T	P	F_T	F_L	T	M_L	M_T
	Load case / Comb	204	P6 Bottom					214	P6 Bottom				
1	SIDL-CB	77.05	0	13.72	0	-69.33	0	-481.36	0	24.84	0	-121.21	0
2	SIDL-WC	38.58	0	7.07	0	-35.73	0	-251.44	0	12.91	0	-62.96	0
3	TU(+) Temperature Uniform	-147.56	0	86.03	0	-520.12	0	160.26	0	59.89	0	-366.09	0
4	TU(-)	147.56	0	-86.03	0	520.12	0	-160.26	0	-59.89	0	366.09	0
5	TG(+) Temperature Gradient	101.62	0	12.48	0	-69.98	0	-75.08	0	13.68	0	-73.41	0
6	TG(-)	-10.72	0	-8.94	0	53.67	0	4.52	0	-9.05	0	52.03	0
7	BRAKING	20.08	0	-22.04	0	132.61	0	-18.31	0	-22.06	0	132.74	0
8	WIND(LONG.+X)	32.62	0	-42.19	0	253.44	0	-31.28	0	-42.2	0	253.54	0
9	WIND(TRANS.+Y)	0	-100.92	0	29.04	0	2359.05	0	-192.9	0	39.67	0	3030.58
10	WIND(VERT.+Z)	-59.1	0	-10.52	0	53.16	0	369.11	0	-19.05	0	92.95	0
11	FPLL1	6.41	0.24	1.14	0.38	-5.76	68.59	-40.01	-0.12	2.06	0.36	-10.07	74.57
12	FPLL2	6.41	-0.23	1.14	-0.39	-5.76	-67.09	-40.01	0.13	2.06	-0.37	-10.07	-73.07
13	BARGE IMPACT	-125.41	-315.55	-95	74.96	427.91	1670.52	130.15	-222.53	-41.91	53.8	240.95	1750.08
14	WATER CURRENT	-0.84	-1.63	-1.32	0.24	4.69	6.22	0.85	-2.2	-1.32	0.19	4.69	10.18
15	HYDRODYNAMIC FORCE	-6.65	-0.46	-10.17	0.07	33.64	1.58	6.71	-0.62	-10.17	0.05	33.63	2.69
16	BUYOANCY	-3.63	0	-0.19	0	0.86	0	3.22	0	-0.15	0	0.67	0
17	XX(RS)	656.2	0	390.23	0	2309.79	0	628.1	0	390.35	0	2310.68	0
18	YY(RS)	0	218.24	0	100.44	0.01	5059.42	0	505.94	0	133.95	0	7194.84
19	ZZ(RS)	796.63	0	89.08	0	566.32	0	825.1	0	88.13	0	561.14	0
20	CLASS A(L1)(max)	172.08	0.78	10.97	1.12	28.76	0	85.78	1.36	14.03	1.21	23.12	0
21	CLASS A(L2)(max)	172.08	0.66	10.97	0.82	28.76	66.87	85.78	0.48	14.03	0.81	23.12	72.65
22	CLASS 70R(L1)(max)	269.81	0.62	17.38	0.85	46.35	0	154.08	1.03	21.88	0.92	36.86	0
23	CLASS A(L1)(min)	-155.23	-1.54	-6.22	-1.91	-52.92	-156.04	-270.29	-1.13	-5.04	-1.89	-67.08	-169.52
24	CLASS A(L2)(min)	-155.23	-0.33	-6.22	-0.48	-52.92	0	-270.29	-0.58	-5.04	-0.52	-67.08	0
25	CLASS 70R(L1)(min)	-234.45	-1.2	-10.05	-1.51	-84.81	-114.28	-422.34	-0.97	-8.07	-1.47	-105.56	-123.71
26	CLASS A(L1)(all)	172.08	-1.54	10.97	-1.91	-52.92	-156.04	-270.29	1.36	14.03	-1.89	-67.08	-169.52
27	CLASS A(L2)(all)	172.08	0.66	10.97	0.82	-52.92	66.87	-270.29	-0.58	14.03	0.81	-67.08	72.65
28	CLASS 70R(L1)(all)	269.81	-1.2	17.38	-1.51	-84.81	-114.28	-422.34	1.03	21.88	-1.47	-105.56	-123.71
29	SLC(max)	137.66	0	7.12	0	32.54	0	122.08	0	5.6	0	25.28	0
30	SLC(min)	-137.66	0	-7.12	0	-32.54	0	-122.08	0	-5.6	0	-25.28	0
31	SLC(all)	137.66	0	7.12	0	-32.54	0	122.08	0	5.6	0	-25.28	0
32	DL	-1297.7	0	-60.16	0	330.84	0	-2311.1	0	43.92	0	-156.73	0
33	TEND_P	0	0	0	0	0	0	0	0	0	0	0	0
34	TEND_S	-296.26	0	-30.15	0	227.83	0	336.59	0	-126.73	0	647	0
35	TEND_PS	-296.26	0	-30.15	0	227.83	0	336.59	0	-126.73	0	647	0
36	CS_S	131.99	0	-112.7	0	670.11	0	-151.21	0	-95.98	0	570.33	0
37	EQ_xx(E)(max)	656.2	0	390.23	0	2309.79	0	628.1	0	390.35	0	2310.68	0
38	EQ_yy(E)(max)	0	218.24	0	100.44	0.01	5059.42	0	505.94	0	133.95	0	7194.84
39	EQ_zz(E)(max)	796.63	0	89.08	0	566.32	0	825.1	0	88.13	0	561.14	0

5.2.3

S.No.	Load	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)
		P	F_T	F_L	T	M_L	M_T	P	F_T	F_L	T	M_L	M_T
	Load case / Comb	204	P6 Bottom					214	P6 Bottom				
40	ULS-Base cb2(36)(max)	-1366.9	77.86	15.85	24.77	969.75	1936.01	-3419.5	147.25	101.62	32.82	623.27	2454.13
41	ULS-Base cb2(55)(max)	-1739.1	-151.38	-127.98	43.56	978.26	3538.57	-3366.5	-289.35	-46.04	59.51	681.32	4545.87
42	ULS-Accid cb(max)	-1033.4	316.96	62.52	76.91	1025.95	1779.26	-2446.5	224.2	40.54	55.8	678.67	1868.25
43	ULS-EQ-X(PIER)(max)	-1531.9	19.36	50.32	9.26	1275.97	469.17	-3584.5	44.46	121.21	12.19	915.61	657.46
44	ULS-EQ-Y(PIER)(max)	-1582.3	105.13	-1.58	48.73	971.02	2457.52	-3629.2	243.3	69.24	64.83	610.24	3485.03
45	ULS-EQ-Z(PIER)(max)	-1493.4	20.02	-8.75	9.56	934.64	484.34	-3534.4	45.98	61.91	12.59	573	679.05
46	ULS-CBS(PIER)(max)	-1033.4	316.96	62.52	76.91	1275.97	3538.57	-2446.5	243.3	121.21	64.83	915.61	4545.87
47	LCB70(max)	137.66	0	7.12	0	32.54	0	122.08	0	5.6	0	25.28	0
48	ULS-Basic CB1(DL-1)(max)	-756.75	-88	-23.95	30.03	1018.4	2340.62	-2141.9	-170.26	21.49	39.7	881.17	2963.86
49	ULS-BaseCB2(36,DL-1)(max)	-850.83	-149.21	-60.24	46.55	1134.97	3705.3	-2000.2	-286.78	-12.8	62.57	1027.64	4727.07
50	ULS-BaseCB2(55,DL-1)(max)	-1340.8	-151.38	-117.02	43.56	913.53	3538.57	-2200.6	-289.35	-79.79	59.51	825.83	4545.87
51	EQ_xx(E)(min)	-656.2	0	-390.23	0	-2309.8	0	-628.1	0	-390.35	0	-2310.7	0
52	EQ_yy(E)(min)	0	-218.24	0	-100.44	-0.01	-5059.4	0	-505.94	0	-133.95	0	-7194.8
53	EQ_zz(E)(min)	-796.63	0	-89.08	0	-566.32	0	-825.1	0	-88.13	0	-561.14	0
54	ULS-Base cb2(36)(min)	-2320.1	-78.41	-160.37	-25.37	-16.4	-2051.4	-4949.9	-147.06	-93.49	-33.34	-450.36	-2579.7
55	ULS-Base cb2(55)(min)	-1916.4	-151.38	-159.54	43.56	818.77	3538.57	-4473.9	-289.35	-103.18	59.51	402.48	4545.87
56	ULS-Accid cb(min)	-1880	-317.32	-190.85	-77.3	-173.07	-1854.5	-3374.4	-224.08	-110.61	-56.14	-164.48	-1950.1
57	ULS-EQ-X(PIER)(min)	-2209.9	-19.46	-208.41	-9.36	-253.77	-489.24	-4270.4	-44.43	-138.49	-12.28	-618.55	-679.3
58	ULS-EQ-Y(PIER)(min)	-2159.5	-105.23	-156.52	-48.84	51.18	-2477.6	-4225.7	-243.27	-86.52	-64.92	-313.18	-3506.9
59	ULS-EQ-Z(PIER)(min)	-2248.4	-20.12	-149.34	-9.66	87.57	-504.42	-4320.5	-45.95	-79.19	-12.68	-275.94	-700.88
60	ULS-CBS(PIER)(min)	-2453	-317.32	-208.41	-77.3	-253.77	-2477.6	-5307.4	-289.35	-138.49	-64.92	-618.55	-3506.9
61	LCB70(min)	-137.66	0	-7.12	0	-32.54	0	-122.08	0	-5.6	0	-25.28	0
62	ULS-Basic CB1(DL-1)(min)	-2054.7	-94.38	-169.61	21.45	236.32	1755.11	-4141.5	-176.72	-147.45	31.02	-8.62	2327.43
63	ULS-BaseCB2(36,DL-1)(min)	-1941.7	-154.11	-188.95	39.97	449.25	3256.41	-4131.2	-291.74	-173.17	55.92	194.89	4239.14
64	ULS-BaseCB2(55,DL-1)(min)	-1518.1	-151.38	-148.58	43.56	754.04	3538.57	-3307.9	-289.35	-136.93	59.51	546.98	4545.87
65	EQ_xx(E)(all)	656.2	0	390.23	0	2309.79	0	628.1	0	390.35	0	2310.68	0
66	EQ_yy(E)(all)	0	218.24	0	100.44	0.01	5059.42	0	505.94	0	133.95	0	7194.84
67	EQ_zz(E)(all)	796.63	0	89.08	0	566.32	0	825.1	0	88.13	0	561.14	0
68	ULS-Base cb2(36)(all)	-2320.1	-78.41	-160.37	-25.37	969.75	-2051.4	-4949.9	147.25	101.62	-33.34	623.27	-2579.7
69	ULS-Base cb2(55)(all)	-1916.4	-151.38	-159.54	43.56	978.26	3538.57	-4473.9	-289.35	-103.18	59.51	681.32	4545.87
70	ULS-Accid cb(all)	-1880	-317.32	-190.85	-77.3	1025.95	-1854.5	-3374.4	224.2	-110.61	-56.14	678.67	-1950.1
71	ULS-EQ-X(PIER)(all)	-2209.9	-19.46	-208.41	-9.36	1275.97	-489.24	-4270.4	44.46	-138.49	-12.28	915.61	-679.3
72	ULS-EQ-Y(PIER)(all)	-2159.5	-105.23	-156.52	-48.84	971.02	-2477.6	-4225.7	243.3	-86.52	-64.92	610.24	-3506.9
73	ULS-EQ-Z(PIER)(all)	-2248.4	-20.12	-149.34	-9.66	934.64	-504.42	-4320.5	45.98	-79.19	-12.68	573	-700.88
74	ULS-CBS(PIER)(all)	-2453	-317.32	-208.41	-77.3	1275.97	3538.57	-5307.4	-289.35	-138.49	-64.92	915.61	4545.87
75	LCB70(all)	137.66	0	7.12	0	-32.54	0	122.08	0	5.6	0	-25.28	0
76	ULS-Basic CB1(DL-1)(all)	-2054.7	-94.38	-169.61	30.03	1018.4	2340.62	-4141.5	-176.72	-147.45	39.7	881.17	2963.86
77	ULS-BaseCB2(36,DL-1)(all)	-1941.7	-154.11	-188.95	46.55	1134.97	3705.3	-4131.2	-291.74	-173.17	62.57	1027.64	4727.07
78	ULS-BaseCB2(55,DL-1)(all)	-1518.1	-151.38	-148.58	43.56	913.53	3538.57	-3307.9	-289.35	-136.93	59.51	825.83	4545.87

5.2.3

S.No.	Load	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)	Axial (tonf)	Shear-y (tonf)	Shear-z (tonf)	Torsion (tonf·m)	Moment-y (tonf·m)	Moment-z (tonf·m)
		P	F_T	F_L	T	M_L	M_T	P	F_T	F_L	T	M_L	M_T
	Load case / Comb	204	P6 Bottom					214	P6 Bottom				
79	ULS-EQ-X(PIER)(max)	-1531.9	19.36	50.32	9.26	1275.97	469.17	-3584.5	44.46	121.21	12.19	915.61	657.46
80	ULS-EQ-Y(PIER)(max)	-1660.7	65.85	-27.46	30.65	815.71	1546.82	-3707.6	152.23	43.4	40.72	455.16	2189.96
81	ULS-EQ-Z(PIER)(max)	-1493.4	20.02	-8.75	9.56	934.64	484.34	-3534.4	45.98	61.91	12.59	573	679.05
82	ULS-CBS(PIER)(max)	-1033.4	316.96	62.52	76.91	1275.97	3705.3	-2446.5	291.92	147.55	62.57	915.61	4727.07
83	ULS-EQ-X(PIER)(min)	-2209.9	-19.46	-208.41	-9.36	-253.77	-489.24	-4270.4	-44.43	-138.49	-12.28	-618.55	-679.3
84	ULS-EQ-Y(PIER)(min)	-2081.1	-65.94	-130.63	-30.76	206.49	-1566.9	-4147.2	-152.2	-60.68	-40.81	-158.1	-2211.8
85	ULS-EQ-Z(PIER)(min)	-2248.4	-20.12	-149.34	-9.66	87.57	-504.42	-4320.5	-45.95	-79.19	-12.68	-275.94	-700.88
86	ULS-CBS(PIER)(min)	-2453	-317.32	-208.41	-77.3	-253.77	-3820.7	-5251.1	-291.74	-139.42	-63.09	-710.22	-4852.6
87	ULS-EQ-X(PIER)(all)	-2209.9	-19.46	-208.41	-9.36	1275.97	-489.24	-4270.4	44.46	-138.49	-12.28	915.61	-679.3
88	ULS-EQ-Y(PIER)(all)	-2081.1	-65.94	-130.63	-30.76	815.71	-1566.9	-4147.2	152.23	-60.68	-40.81	455.16	-2211.8
89	ULS-EQ-Z(PIER)(all)	-2248.4	-20.12	-149.34	-9.66	934.64	-504.42	-4320.5	45.98	-79.19	-12.68	573	-700.88
90	ULS-CBS(PIER)(all)	-2453	-317.32	-208.41	-77.3	1275.97	-3820.7	-5251.1	291.92	147.55	-63.09	915.61	-4852.6
91	SLS-RARE-CBS(max)	-603.53	1.88	-36.54	30.99	1897.26	2467.78	-2234.3	2.23	-5.51	41.67	1516.15	3148.75
92	SLS-FREQ-CBS(max)	-734.96	1.41	-85.79	17.94	1610.37	1444.42	-2403.2	1.68	-42.29	24.34	1307.09	1849.86
93	SLS-RARE-CBS(min)	-1977	-102.7	-313.66	-3.12	279.53	-245.35	-3970.4	-194.46	-251.89	-3.12	117.34	-266.73
94	SLS-FREQ-CBS(min)	-1869.1	-61.03	-266.18	-2.34	574.57	-184.02	-3751.4	-116.16	-217.42	-2.34	337.08	-200.04
95	SLS-RARE-CBS(all)	-1977	-102.7	-313.66	30.99	1897.26	2467.78	-3970.4	-194.46	-251.89	41.67	1516.15	3148.75
96	SLS-FREQ-CBS(all)	-1869.1	-61.03	-266.18	17.94	1610.37	1444.42	-3751.4	-116.16	-217.42	24.34	1307.09	1849.86
97	SLS SEISMIC-X COMB(max)	-901.79	26.1	-7.91	12.58	2124.71	675.82	-2514.2	59.74	36.46	16.49	1870.29	932.96
98	SLS SEISMIC-Y COMB(max)	-1076.6	87.87	-113.01	41	1502.76	2107.63	-2681.3	202.92	-68.67	54.4	1248.09	2969.1
99	SLS SEISMIC-Z COMB(max)	-853.52	26.76	-88.07	12.88	1661.33	691	-2450.3	61.26	-43.99	16.89	1405.21	954.55
100	SLS SEISMIC-X COMB(min)	-1764	-26.19	-350.95	-12.69	94.42	-694.7	-3407.2	-59.71	-308.24	-16.59	-167.74	-953.59
101	SLS SEISMIC-Y COMB(min)	-1589.3	-87.95	-245.85	-41.11	716.36	-2126.5	-3240.1	-202.89	-203.11	-54.5	454.46	-2989.7
102	SLS SEISMIC-Z COMB(min)	-1812.3	-26.84	-270.79	-12.99	557.8	-709.87	-3471.1	-61.22	-227.78	-16.99	297.34	-975.18
103	SLS SEISMIC-X COMB(all)	-1764	-26.19	-350.95	-12.69	2124.71	-694.7	-3407.2	59.74	-308.24	-16.59	1870.29	-953.59
104	SLS SEISMIC-Y COMB(all)	-1589.3	-87.95	-245.85	-41.11	1502.76	-2126.5	-3240.1	202.92	-203.11	-54.5	1248.09	-2989.7
105	SLS SEISMIC-Z COMB(all)	-1812.3	-26.84	-270.79	-12.99	1661.33	-709.87	-3471.1	61.26	-227.78	-16.99	1405.21	-975.18


Key
2.09% reinforcement
Reference Point
Neutral Axis
Compression Side
Governing Node or Bar
z
y
C
Section 1 - ULS Strength Results
Analysis Case 1

Section 1 Details (Twin leaf Pier)

2.09% reinforcement in section 1 (Section 1). Check this against code requirements.

ULS Cases Analysed

Name	Loading	Pre-stress Factor
1	L1	0.0
2	L2	0.0
3	L3	0.0
4	L4	0.0
5	L5	0.0
6	L6	0.0

Strength Analysis - Loads

Case	N [kN]	M_{yy} [kNm]	M_{zz} [kNm]	M [kNm]	θ [°]
1	9910.	3070.	2239.	3800.	-36.10
2	42370.	-2189.	-11000.	11210.	101.3
3	19350.	-3146.	-14380.	14720.	102.3
4	40590.	-1970.	-11650.	11810.	99.60
5	35840.	7306.	-678.2	7338.	5.303
6	16480.	-11450.	-8714.	14390.	142.7

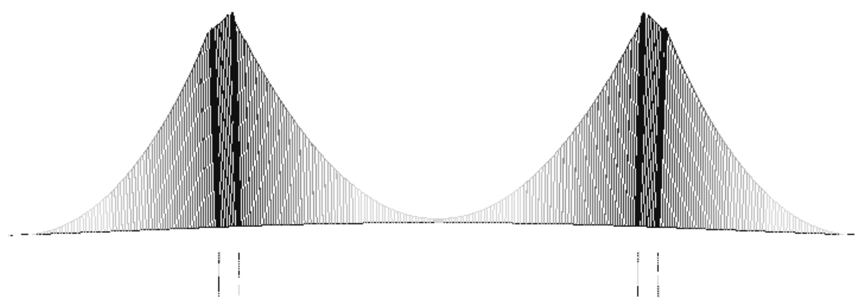
Strength Analysis - Summary

Governing conditions are defined as:
A - reinforcing steel tension strain limit
B - concrete compression strain limit
C - concrete pure compression strain limit
IS 456 Section 39.1
Effective centroid is reported relative to the reference point.

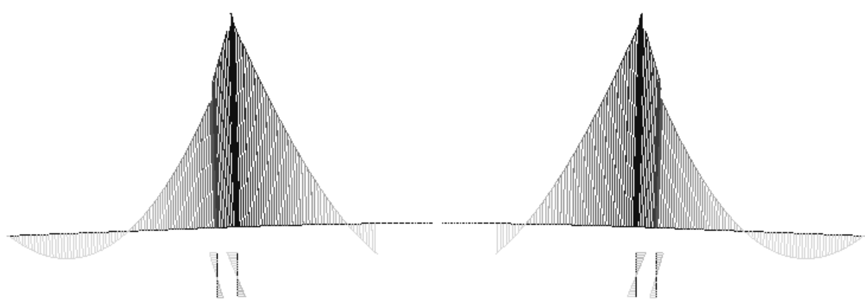
Case	Eff. Centroid (y)	Eff. Centroid (z)	N [kN]	M [kNm]	M_u [kNm]	M/M_u	Governing Condition	Neutral Axis Angle [°]	Neutral Axis Depth [mm]
1	0.1204	1.481E-6	9910.	3800.	42230.	0.08997	A: Bar 1	-85.74	504.2
2	0.1277	1.488E-6	42370.	11210.	36130.	0.3103	B: Node 28	90.87	522.8
3	0.1224	1.483E-6	19350.	14720.	30130.	0.4884	A: Bar 32	90.70	396.0
4	0.1272	1.488E-6	40590.	11810.	35740.	0.3305	B: Node 28	90.74	501.8
5	0.1261	1.487E-6	35840.	7338.	126700.	0.05791	B: Node 23	64.04	1370.
6	0.1218	1.482E-6	16480.	14390.	44590.	0.3227	A: Bar 32	94.19	533.1
Maxima									
3	0.1224	1.483E-6	19350.	14720.	30130.	0.4884	A: Bar 32		
Minima									
5	0.1261	1.487E-6	35840.	7338.	126700.	0.05791	B: Node 23		

5.3 DESIGN OF SUPERSTRUCTURE

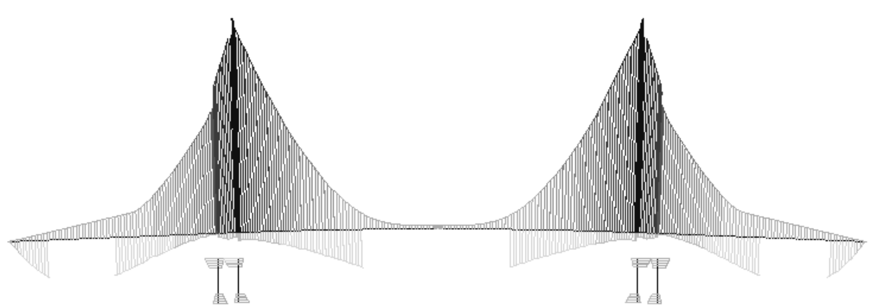
5.3.1 At a glance reference of Bending Moment diagrams of applied loading on the three span continuous bridge



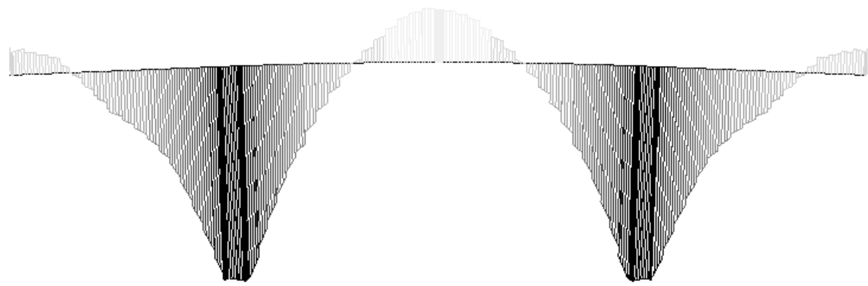
Bending Moment DL



CB



LL



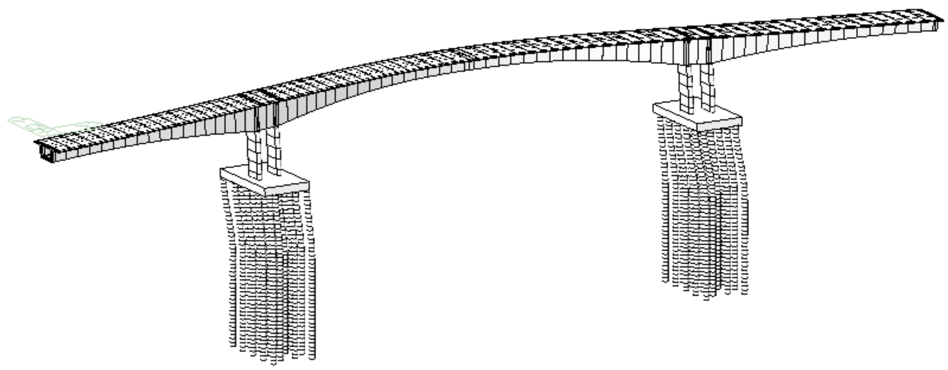
TP

TS

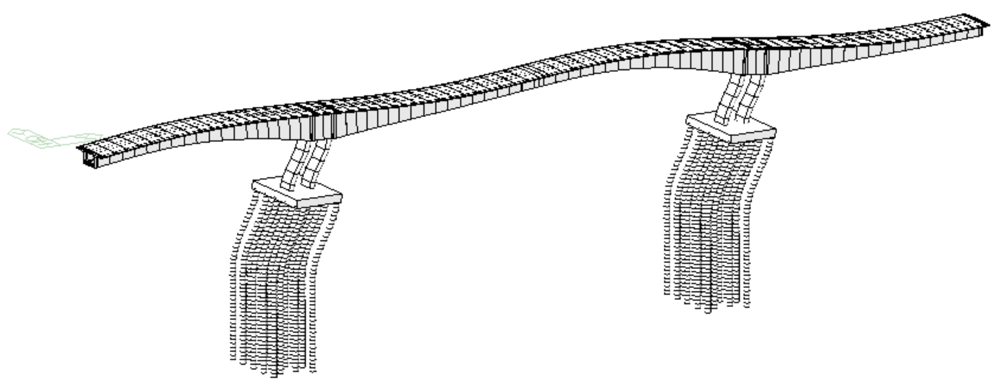
CS

5.3.2 Vibration mode shapes of the bridge (first 10 modes)

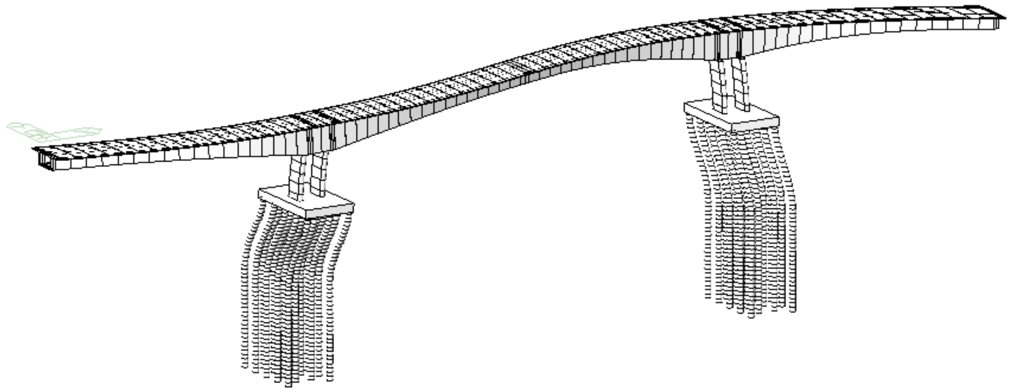
[Reference may be taken from the soft file]



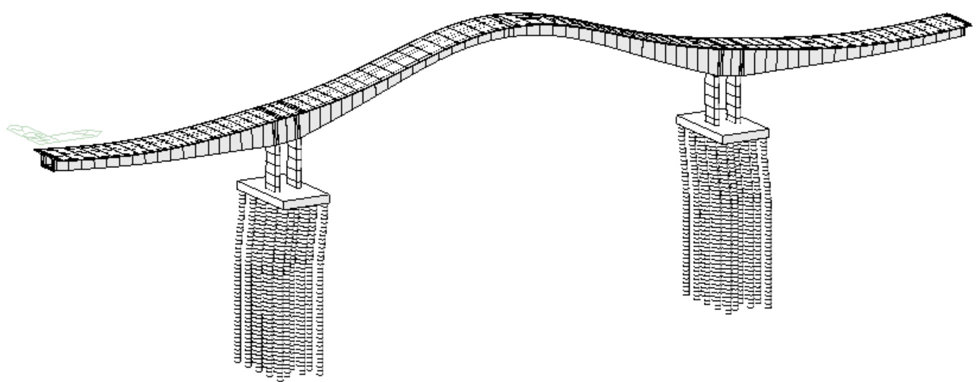
ModeShape1



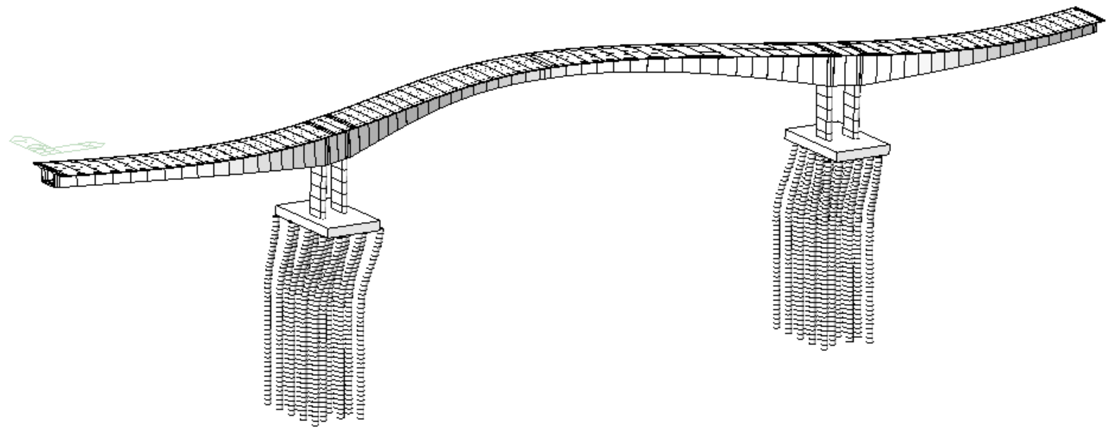
ModeShape2



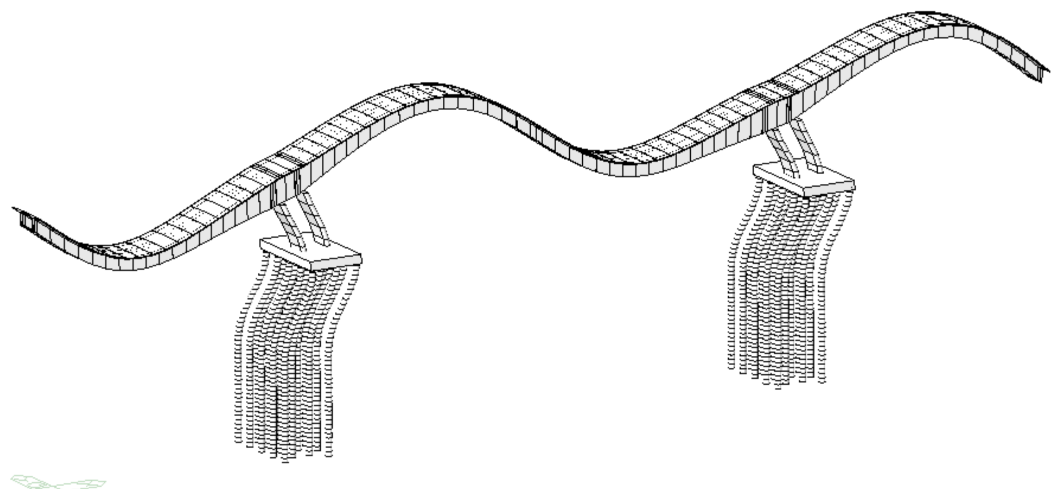
ModeShape3



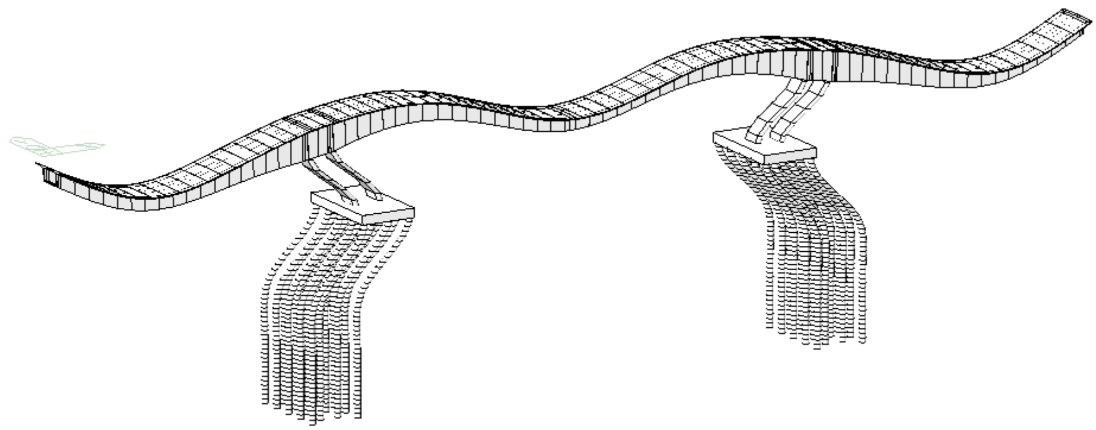
ModeShape4



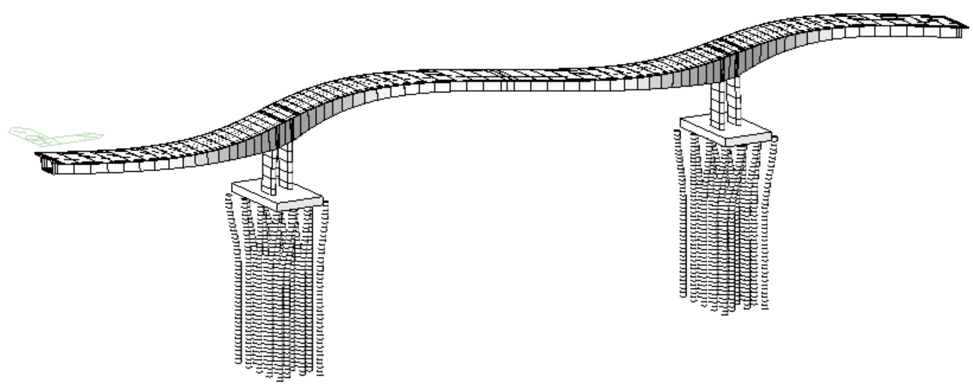
ModeShape5



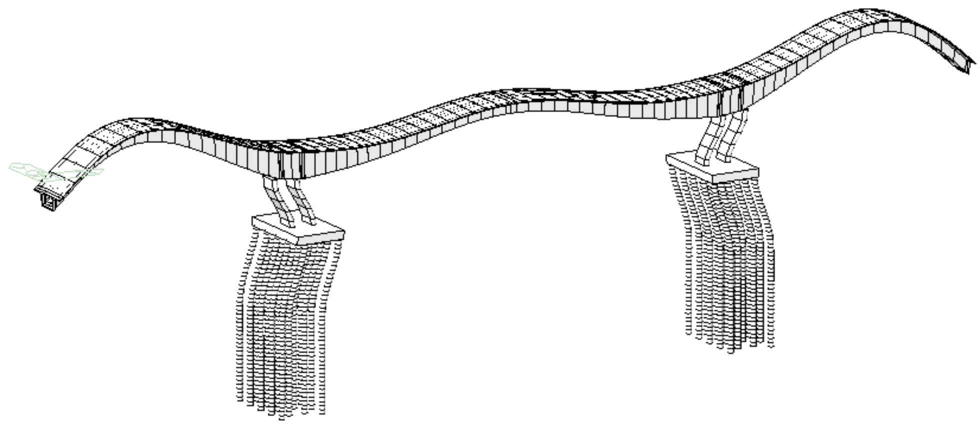
ModeShape6



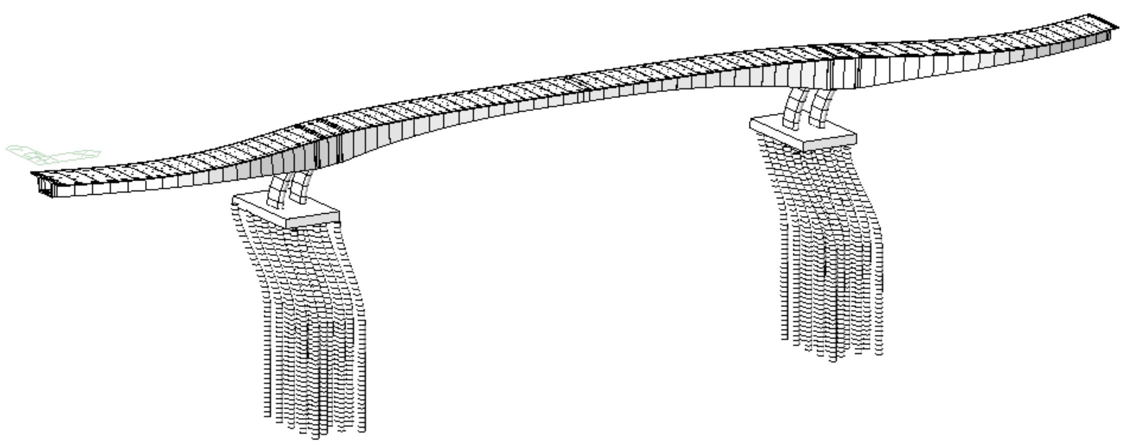
ModeShape7



ModeShape8



ModeShape9



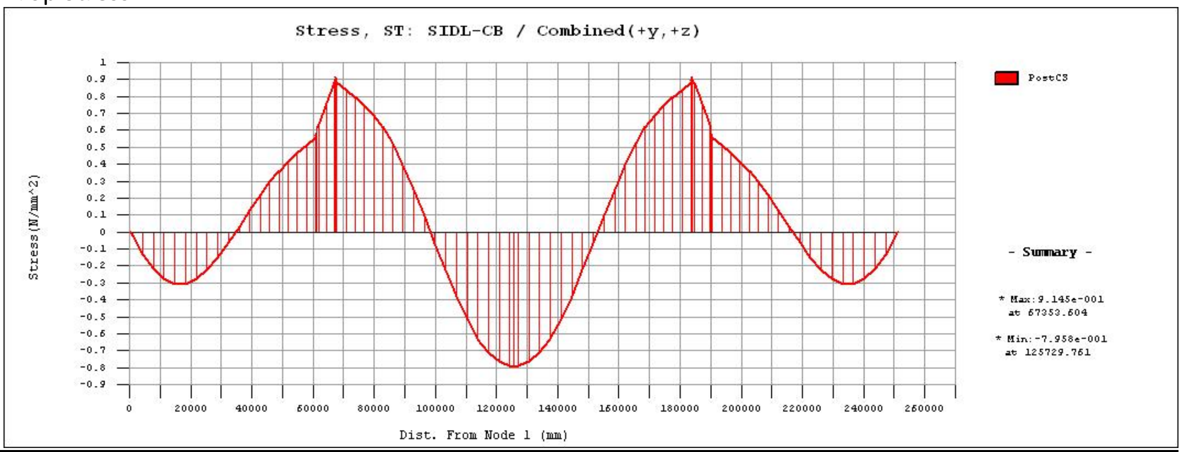
ModeShape10

CHAPTER 6 : RESULT

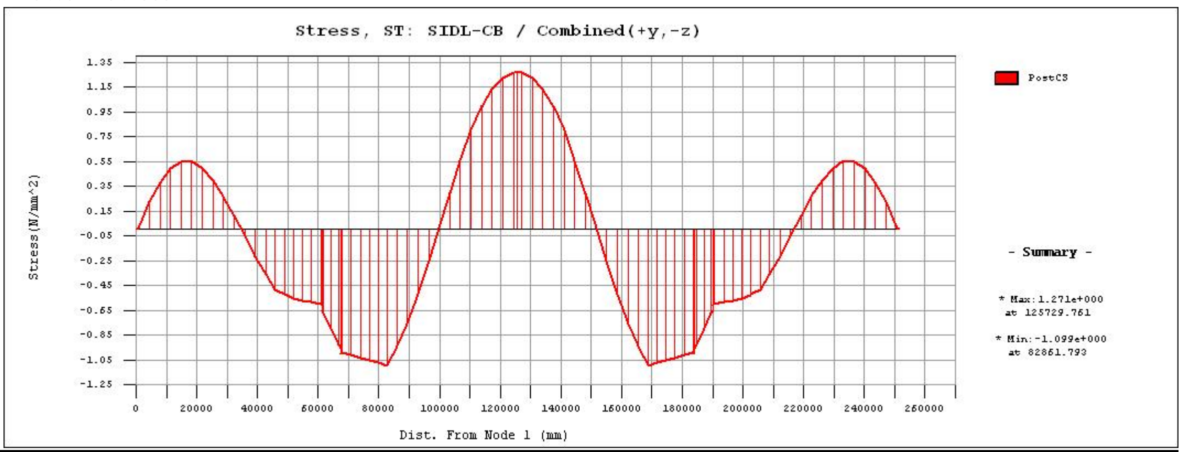
(Stress Check at Service Stage)

SIDL CRASH BARRIER

- Top Stress

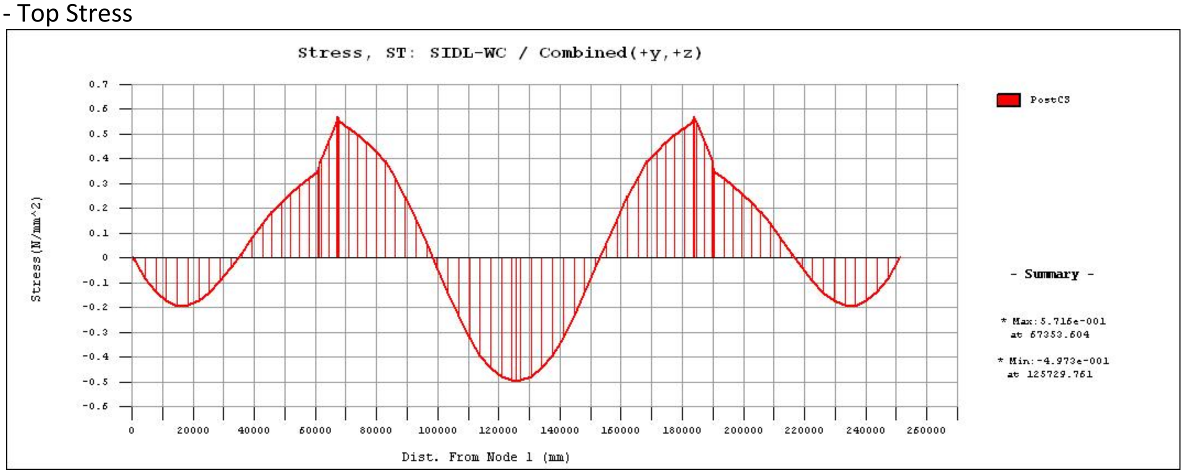


- Bottom Stress

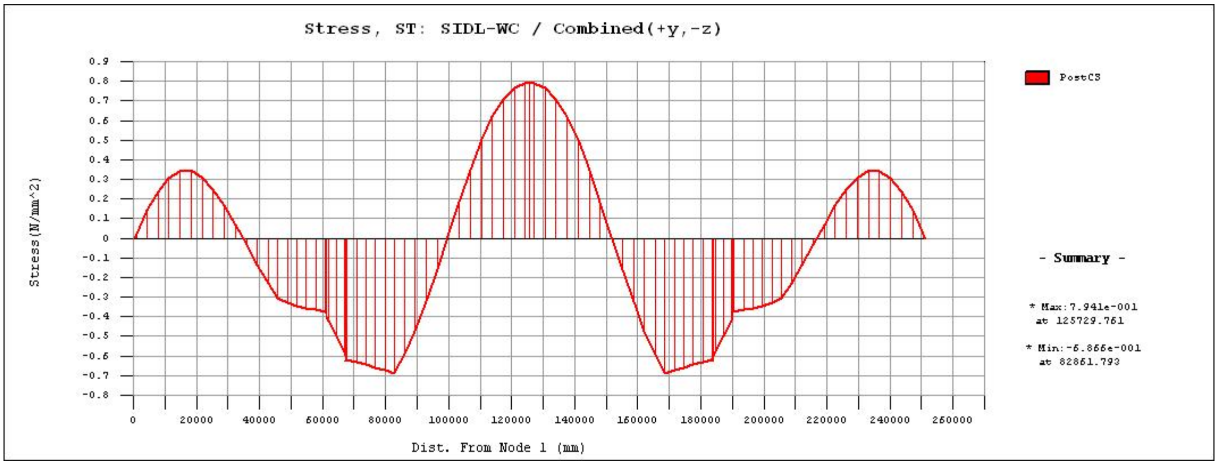


SIDL WEARING COAT

- Top Stress

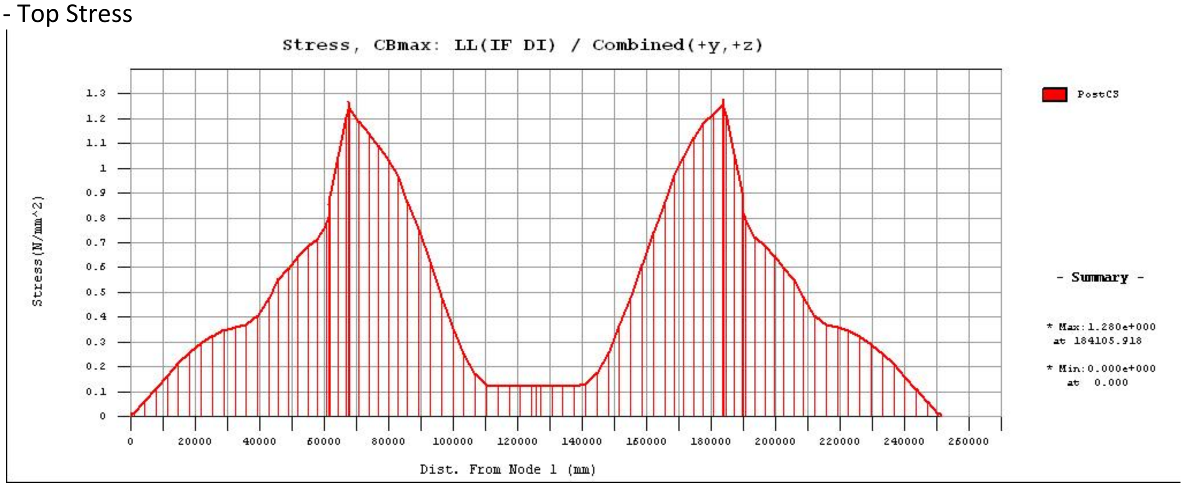


- Bottom Stress

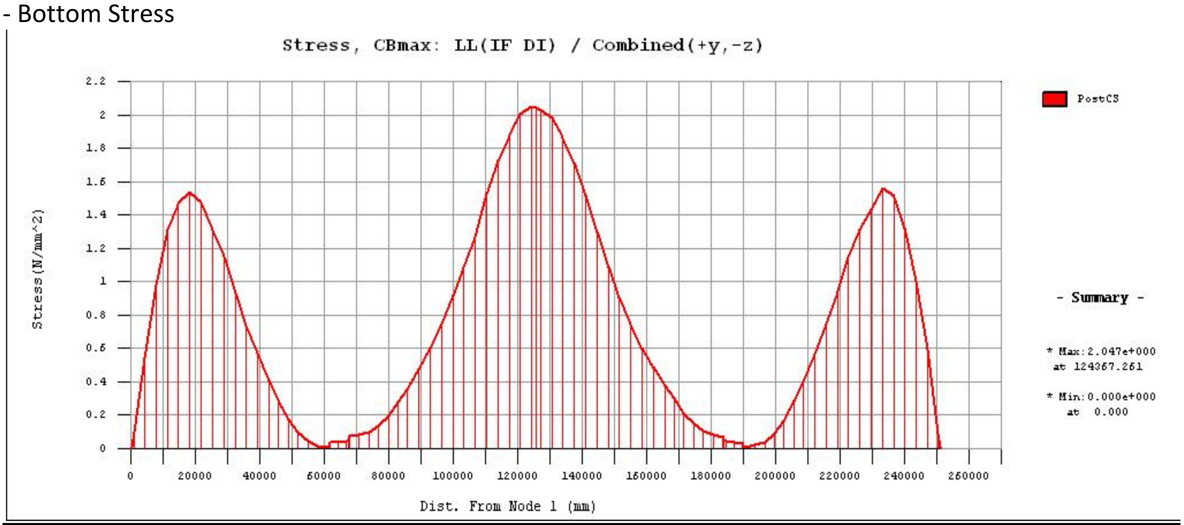


LIVE LOAD

- Top Stress

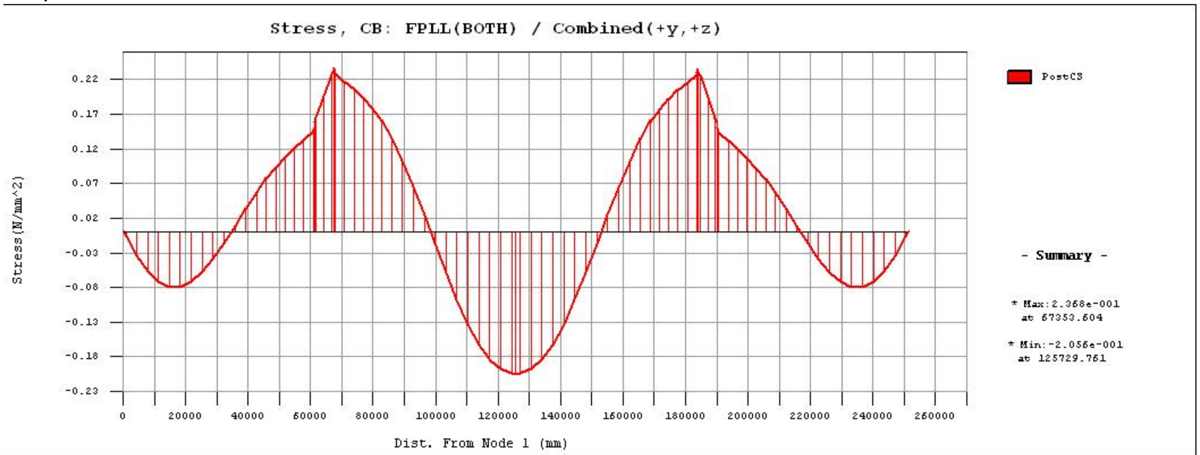


- Bottom Stress

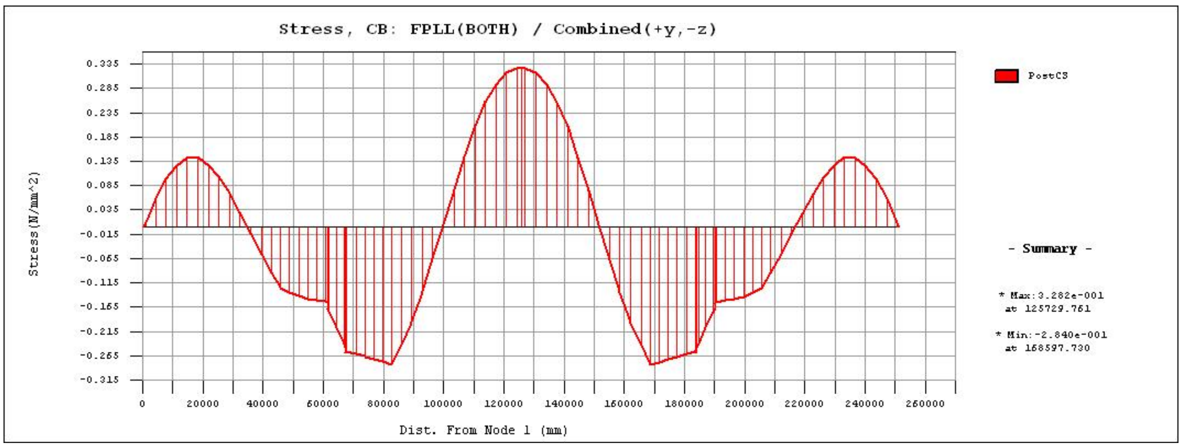


FOOTPATH LIVE LOAD

- Top Stress

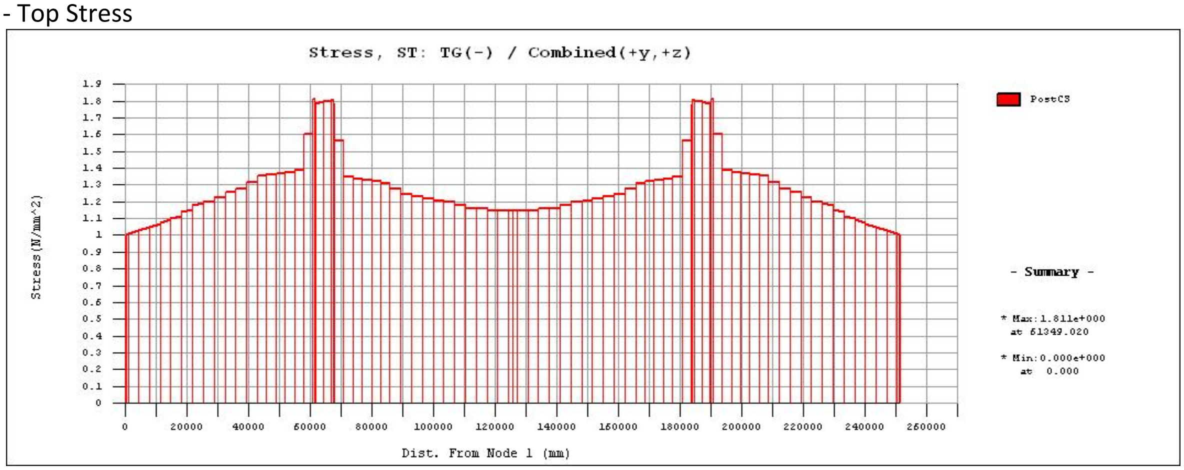


- Bottom Stress

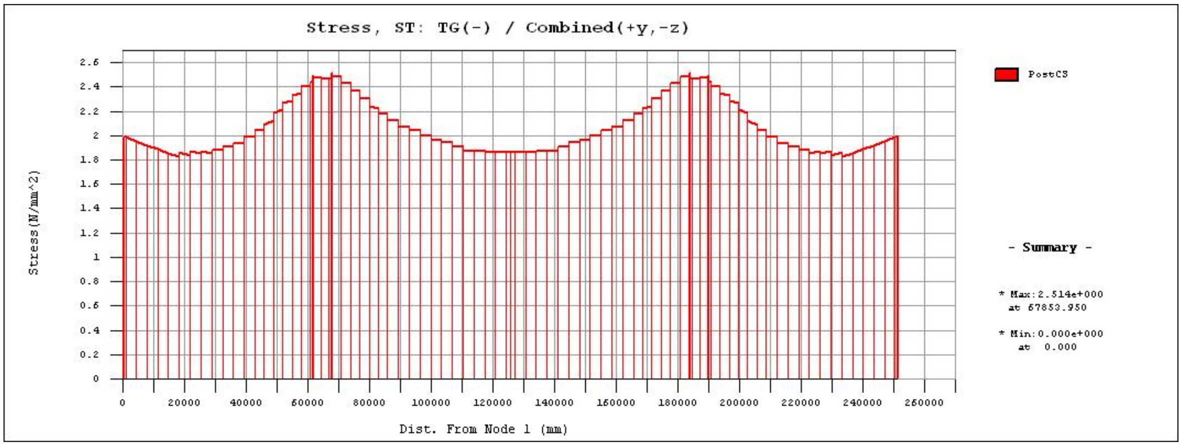


TEMPRATURE GRADIENT (-)

- Top Stress

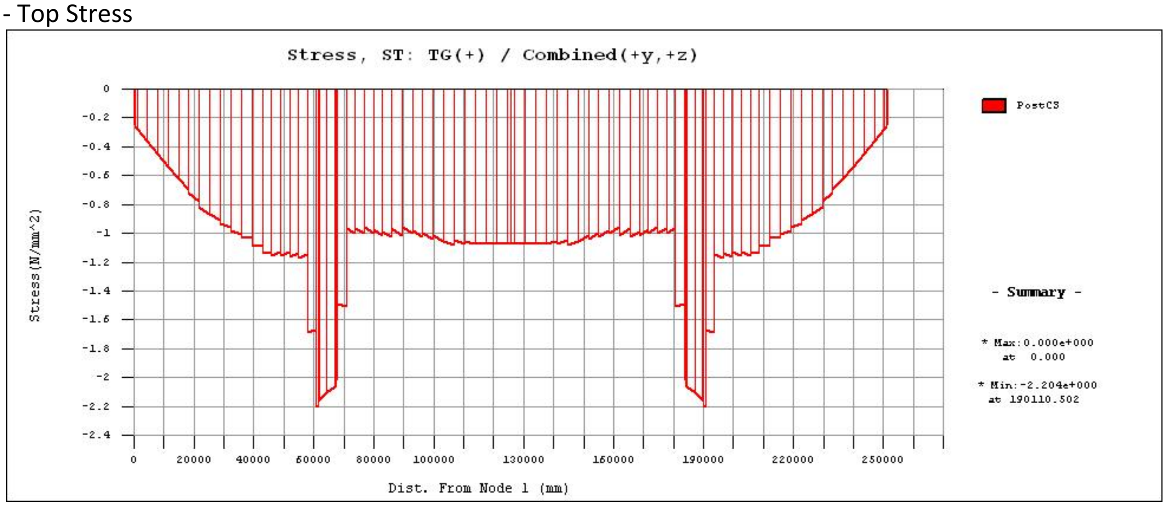


- Bottom Stress

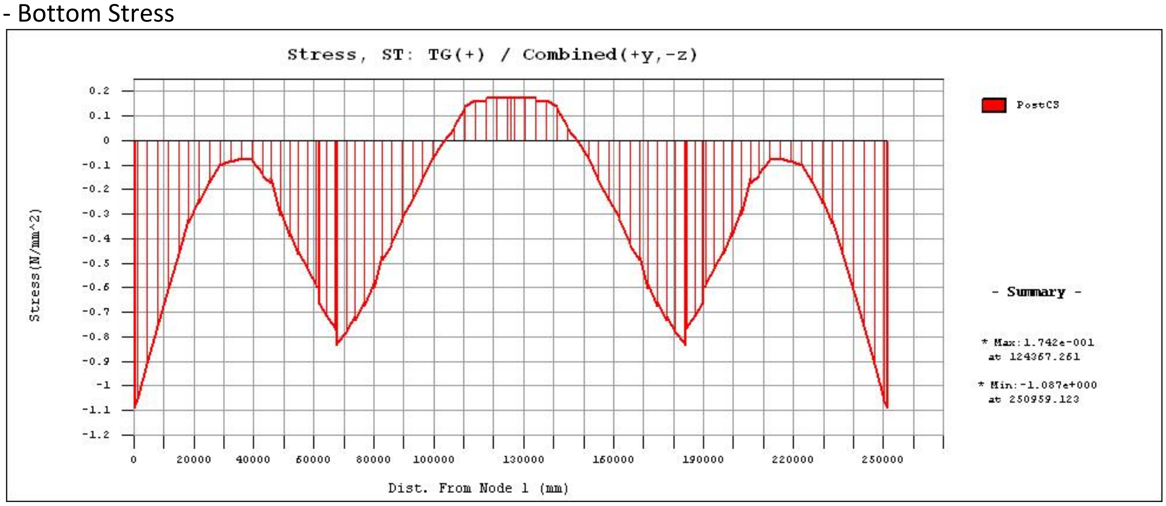


<u>TEMPRATURE GRADIENT (+)</u>

- Top Stress



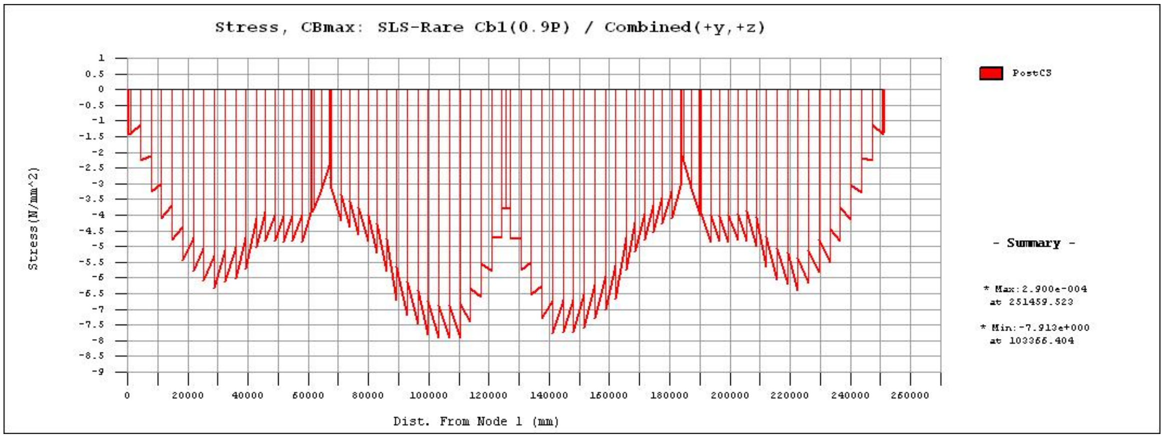
- Bottom Stress



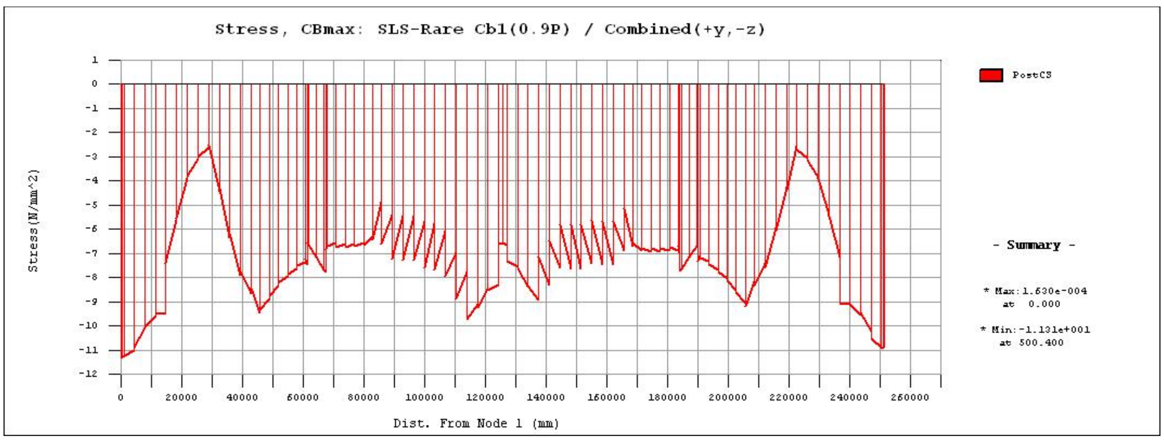
SLS RARE COMBINATIONS (0.9 PRESTRESS)

SLS RARE COMBINATIONS (RC1)

- Top Stress

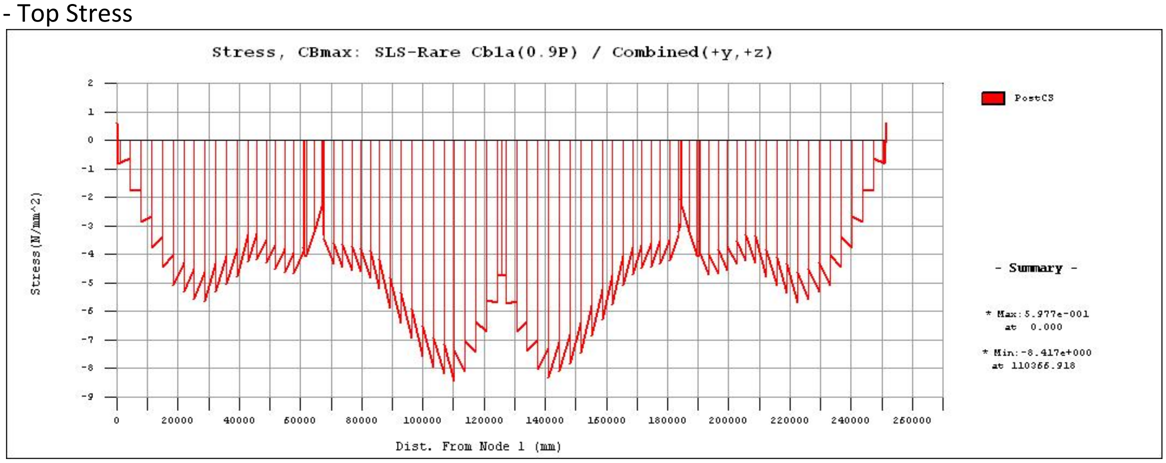


- Bottom Stress

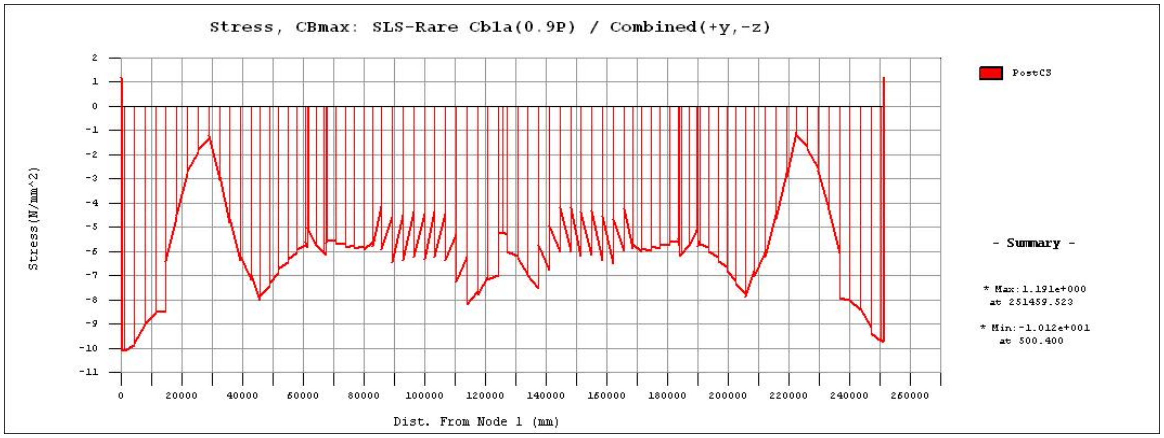


SLS RARE COMBINATIONS (RC1A)

- Top Stress

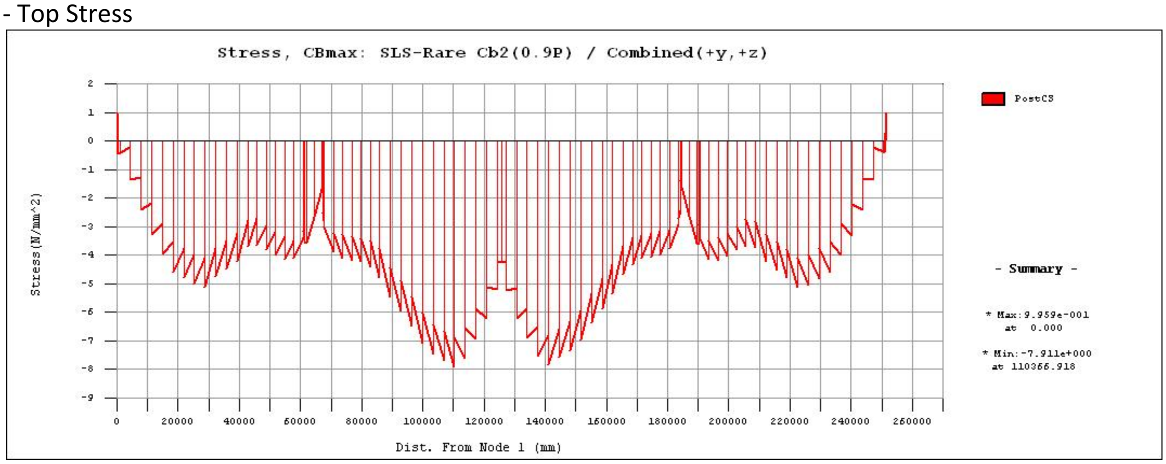


- Bottom Stress

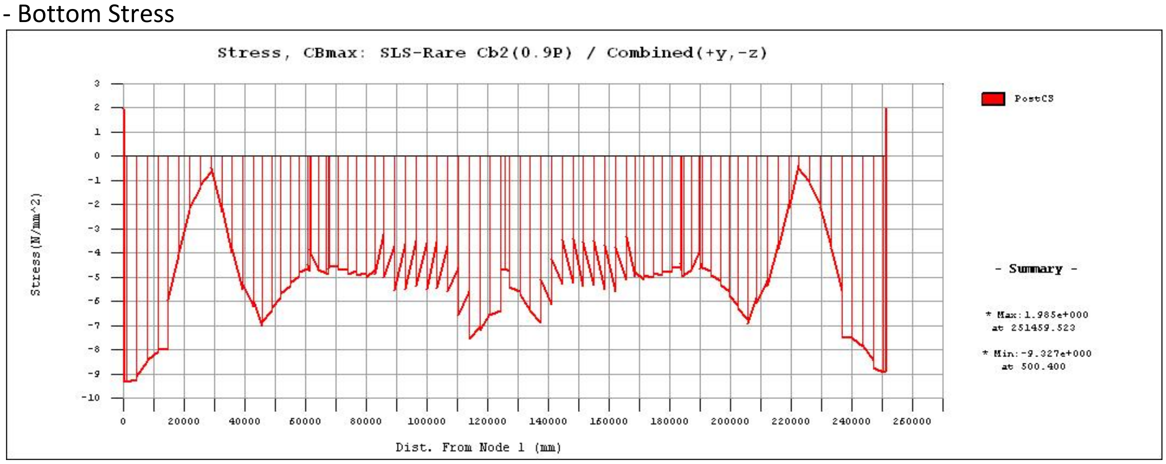


SLS RARE COMBINATIONS (RC2)

- Top Stress

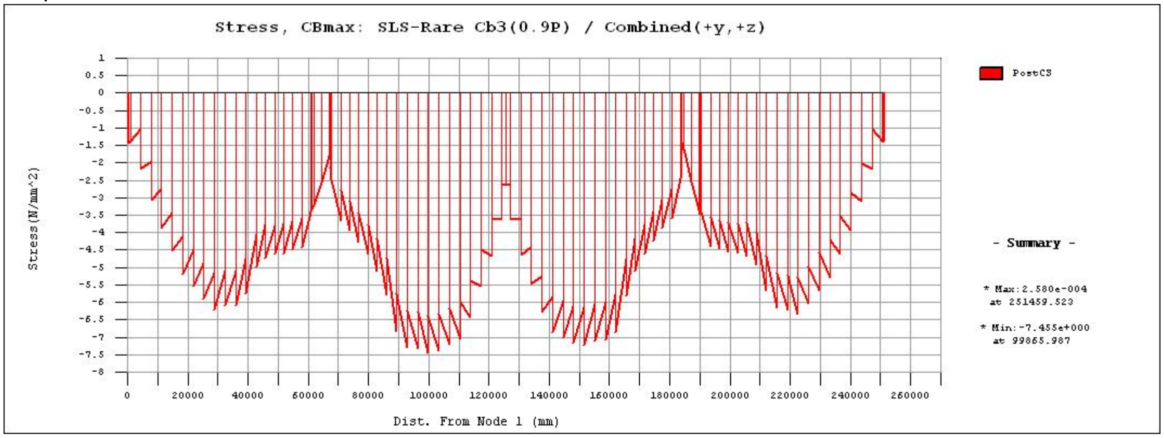


- Bottom Stress

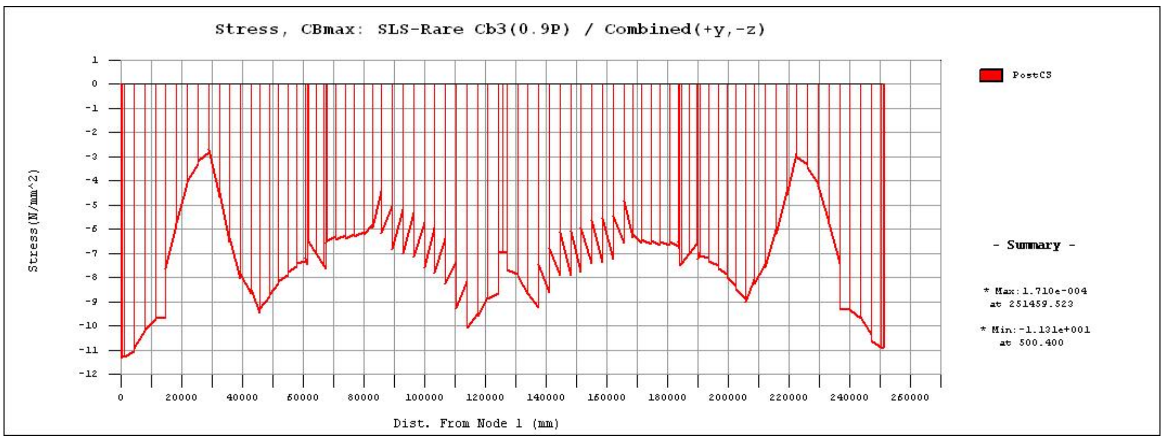


SLS RARE COMBINATIONS (RC3)

- Top Stress



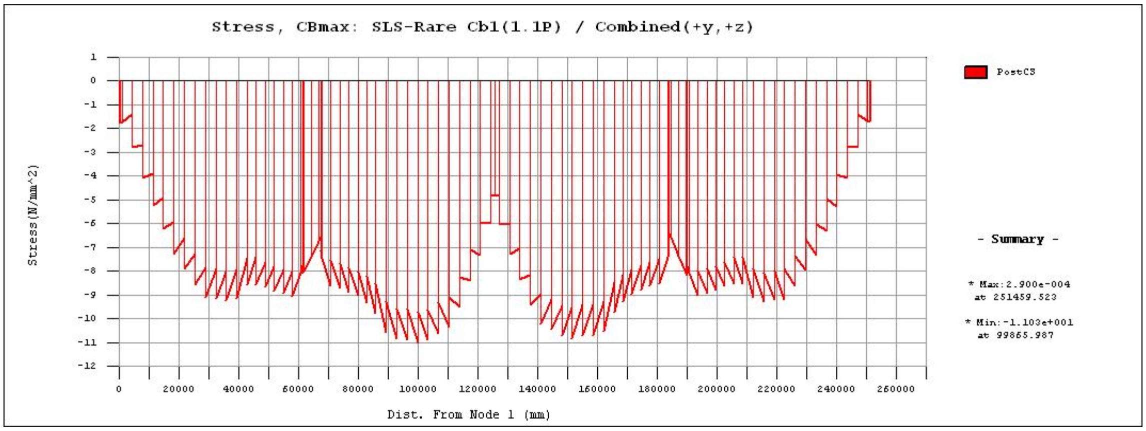
- Bottom Stress



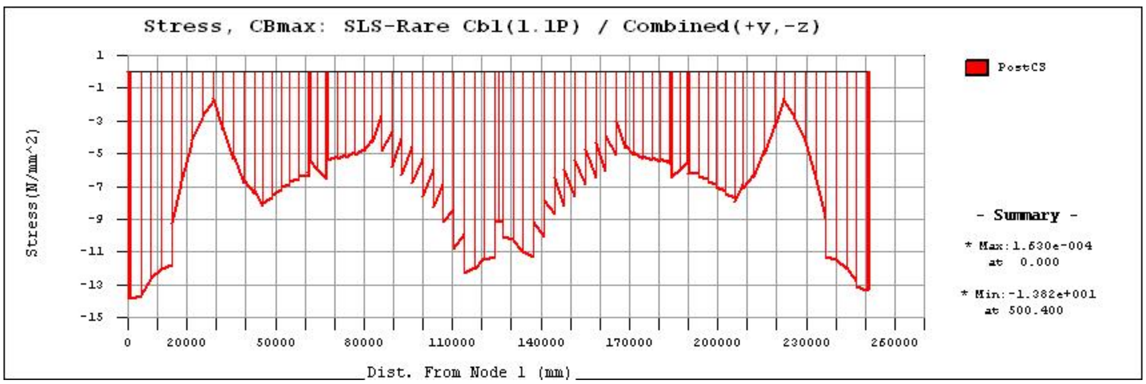
SLS RARE COMBINATIONS (1.1 PRESTRESS)

SLS RARE COMBINATIONS (RC1)

- Top Stress

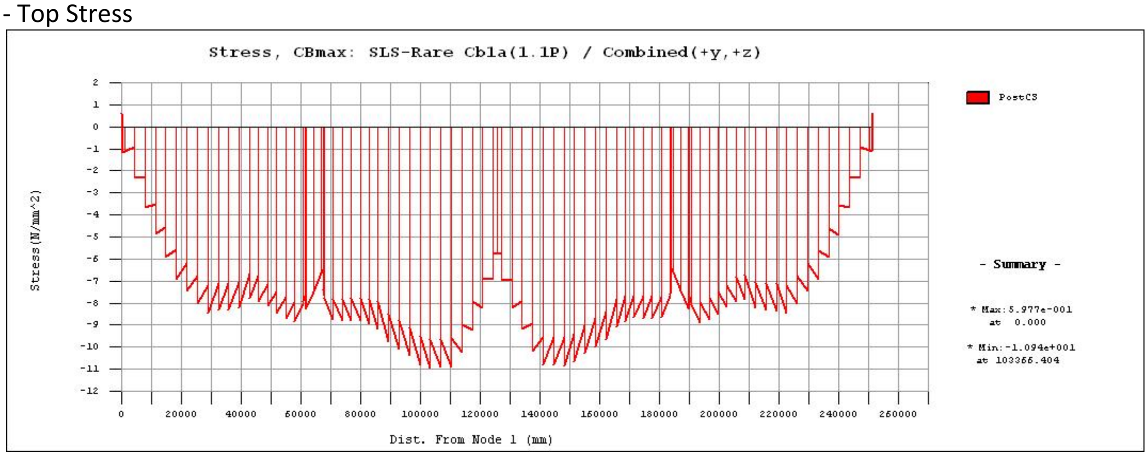


- Bottom Stress

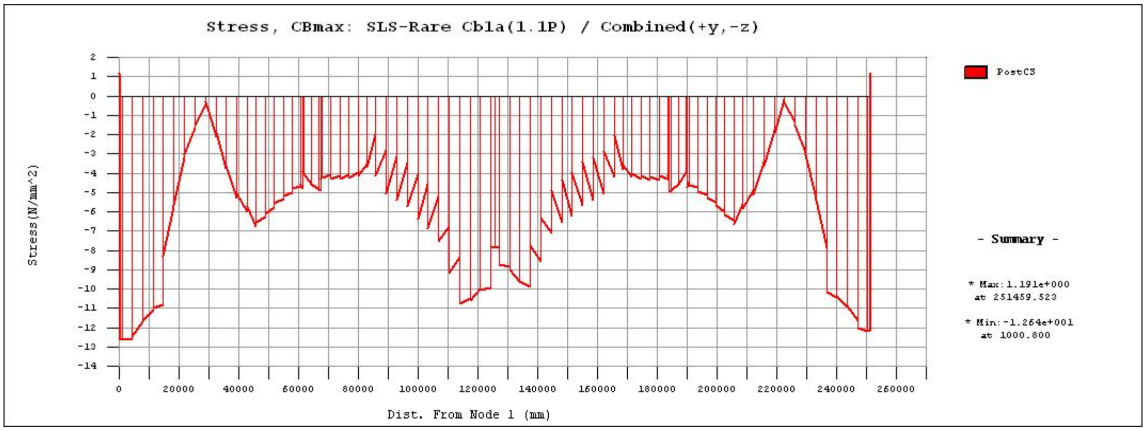


SLS RARE COMBINATIONS (RC1A)

- Top Stress

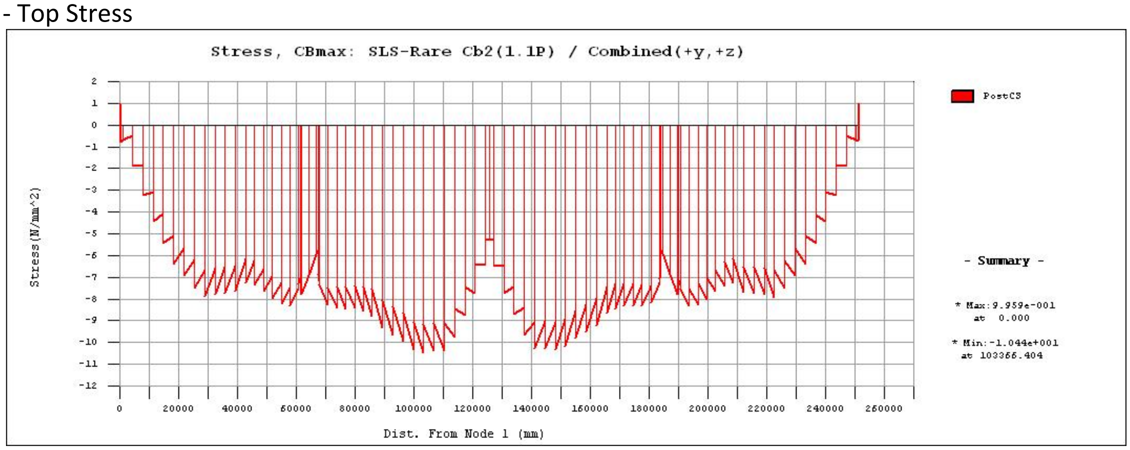


- Bottom Stress

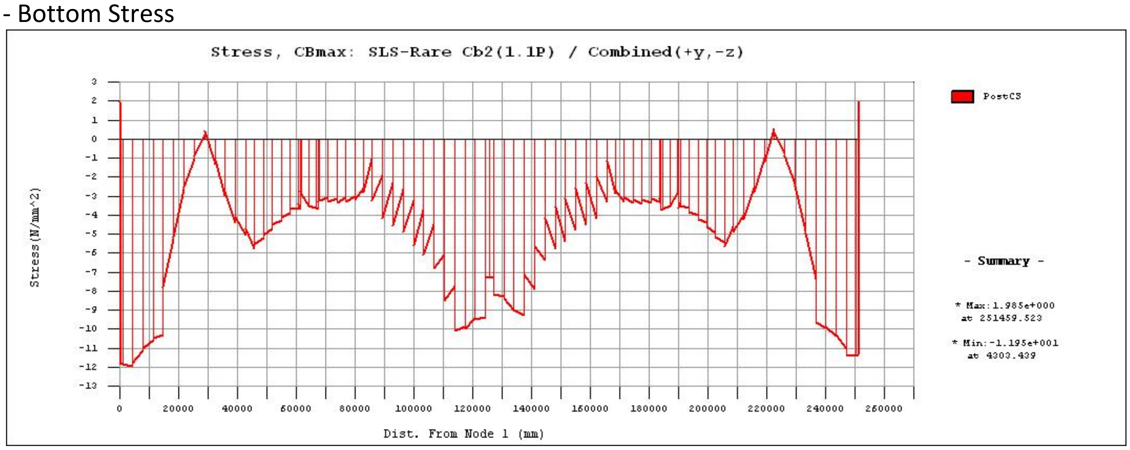


SLS RARE COMBINATIONS (RC2)

- Top Stress

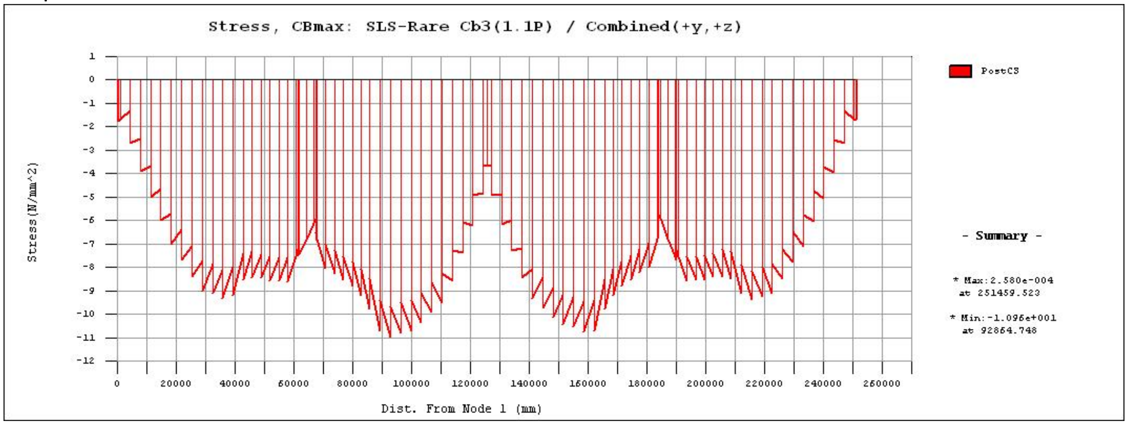


- Bottom Stress

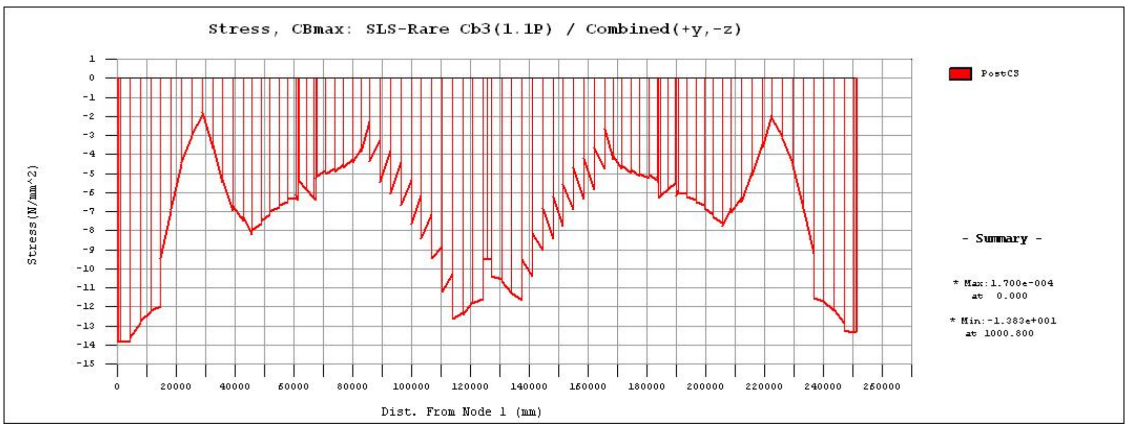


SLS RARE COMBINATIONS (RC3)

- Top Stress



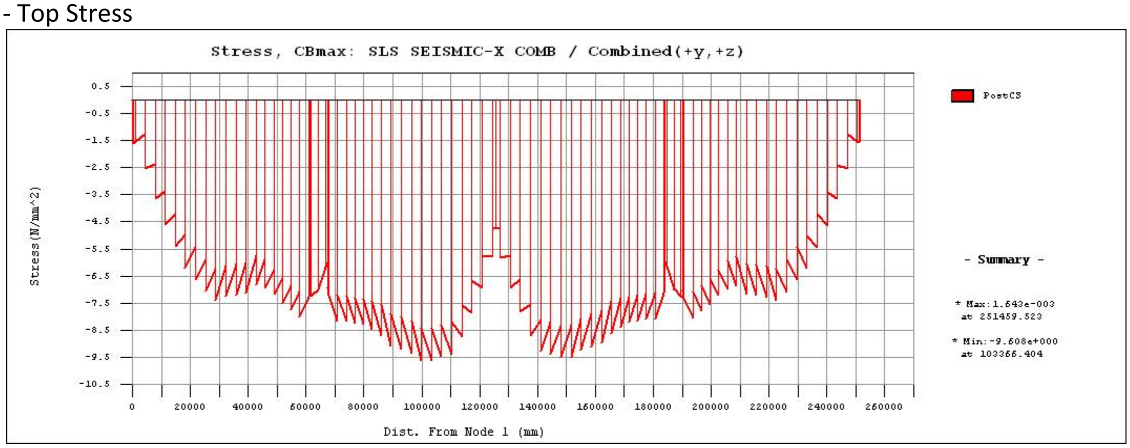
- Bottom Stress



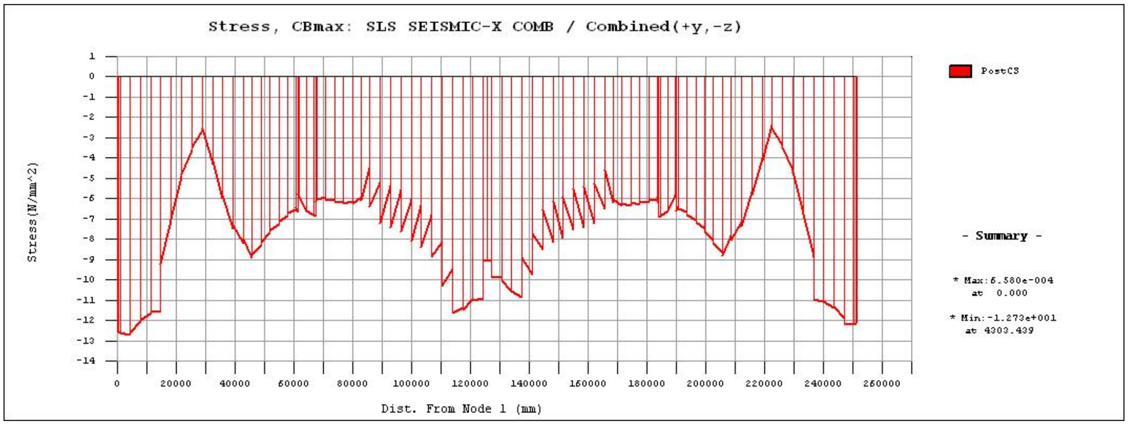
SLS SIESMIC COMB.

SLS SIESMIC LONG.

- Top Stress

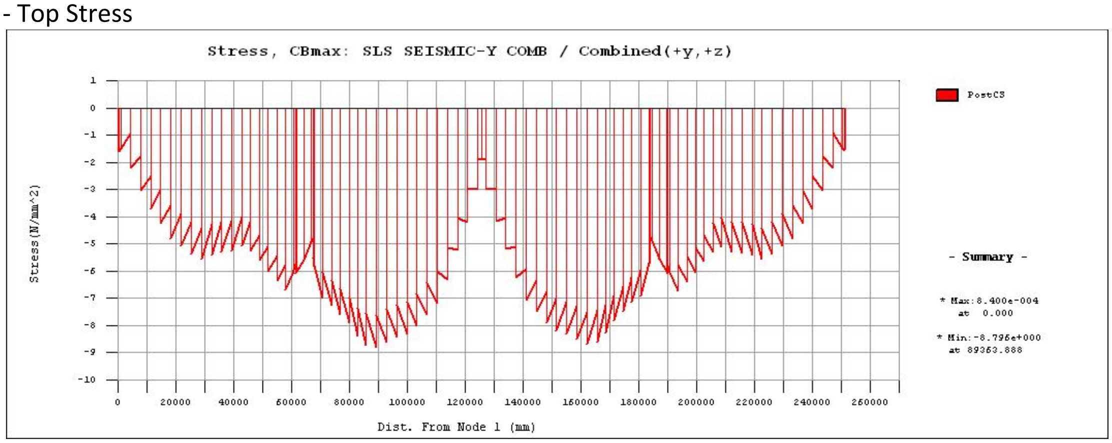


- Bottom Stress

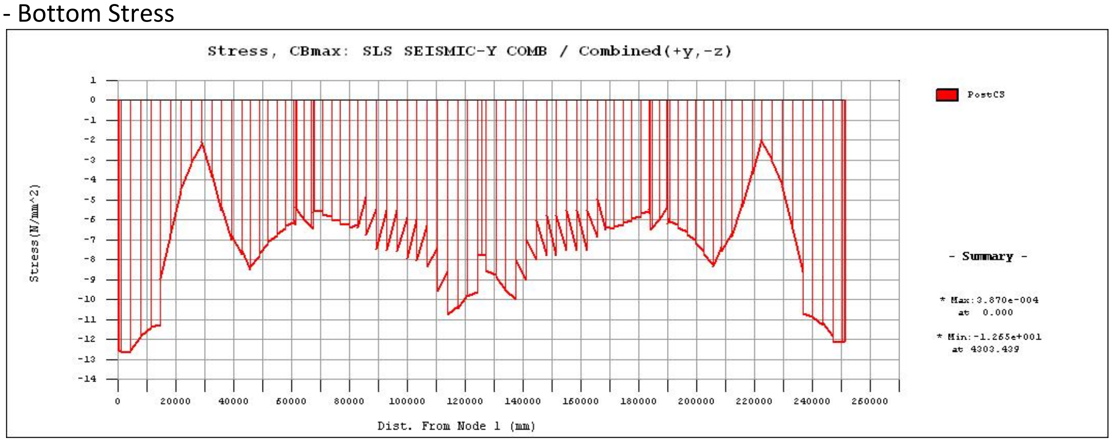


SLS SIESMIC TRANS.

- Top Stress

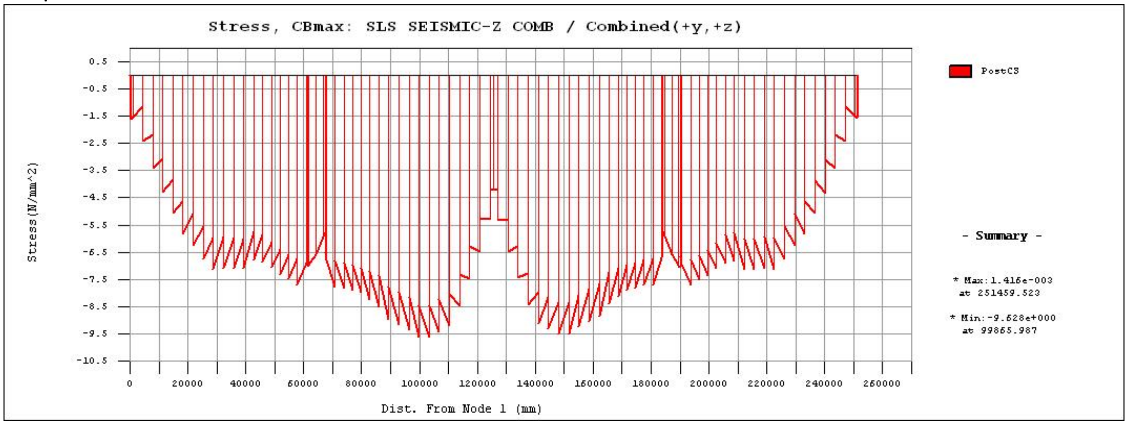


- Bottom Stress

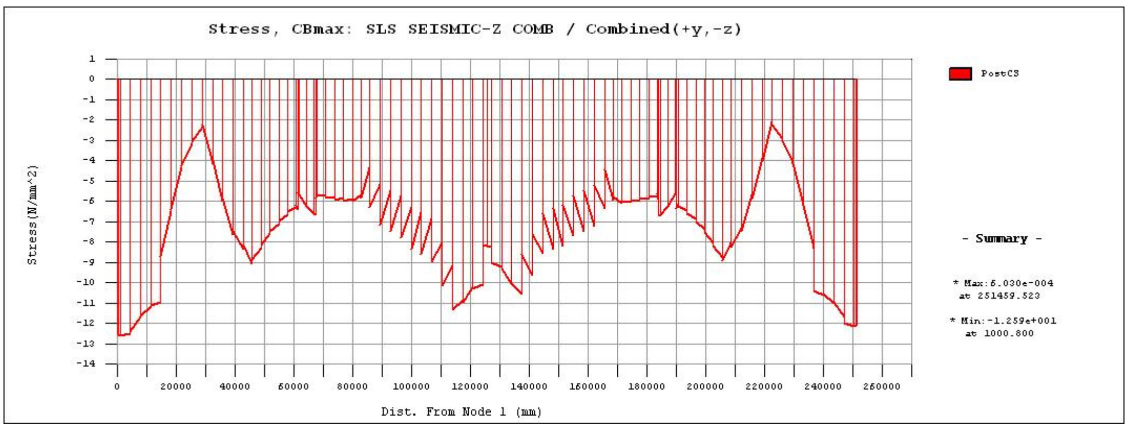


SLS SIESMIC VERT.

- Top Stress



- Bottom Stress



CHAPTER 7 Discussion

This chapter summarizes the principal findings related to the bridge concept described in this thesis and the application of post-tensioned pre-stressing for cantilever construction.

7.1 Longitudinal Design

The increase in stress for internal bonded tendons in a cantilever-constructed girder is small at the ultimate limit state. The increased rotational capacity achieved through the ductile nature of high-strength fibre reinforced concrete does not significantly improve the economy of pre-stressing steel consumption. This is due to the fact that only a small plastic hinge length forms in negative bending regions. However, economy in pre-stressing steel consumption is achieved by reducing the dead load of the girder through the minimization of concrete consumption. The minimization of concrete consumption is achieved through the design of thin section components. In comparison to conventional cast in situ cantilever construction, the demand for longitudinal pre-stressing steel is similar. However, in comparison to conventional overpass bridge construction, the proposed box girder requires only 49% of pre-stressing strand per square meter of bridge deck. The moment development length for a box girder with internal bonded pre-stressing tendons anchored at intermediate corner blisters is much larger than a girder with internal tendons. In addition to the typical spreading of compressive stresses in a cross section to achieve moment resistance, a local spreading of forces is first required to deviate the eccentrically applied pre-stress force into the box section. Continuity tendons should be anchored one segment beyond where they are theoretically required, internal bonded tendons should be anchored two segments beyond where they are theoretically required. A parabolic depth girder appears to be the most economical solution for the intended standardized box girder cantilevered from fixed piers. There are four reasons for this result. First, the reduction in cantilever dead load moment at the fixed end is small due to a decrease in web depth at mid-span. Second, reducing the internal lever arm to the continuity tendons at midspan increases the demand for continuity pre-stressing steel. Third, a larger redistribution of positive bending moment to the mid-span is desirable since it relieves the overturning demand on the substructure. Lastly, for the intent of cast-in-situ and standardization, economy is optimized by maintaining repetitive and standard detailing of struts for a constant depth girder. A span-to-depth ratio of 1:16.5 appears to be a reasonable girder slenderness for design using design mix 50MPa. This girder slenderness satisfies strength requirements, deflection requirements, and provides reasonable visual slenderness.

7.2 Transverse Design

For the design of thin-slabs, a RCC transverse steel concept is necessary. HYSD steel can be placed more compactly in the top slab and the well-distributed arrangement of reinforcement provides a more uniform introduction of tensile force at the web junction and mid of transverse deck slab. The high tensile strength of HYSD 500 D steel facilitates excellent bond strength on 12, 16 and 20 mm dia bar, reducing the transfer length to allow for a sufficient effective bond at the inside face of the barrier. The design of thin slabs using high-strength steel markedly reduces overall concrete consumption and reduces dead load; however, the decrease in flange thickness results in an increased demand for transverse HYSD steel to satisfy serviceability requirements.

7.3 Shear Design

The flow of forces in the webs of box girders pre-stressed with curtailed tendons at intermediate anchorages at the top and bottom flanges is complex. The flow of forces can be separated into a local spreading of forces in the vicinity of the anchorage and a global flow of forces in the cross section to transfer vertical applied load to the supports. As a consistent methodology for modeling the flow of forces in the girder, a parallel chord truss model with chords at the elevation of the flanges is developed for the design of web reinforcement. For the design of thin webs, a single layer of web reinforcement is placed in the central plane of the web axis.

7.4 Anchorage Zone Design

The flow of forces in anchorage zones for girders pre-stressed with internal bonded tendon sat corner blisters is fundamentally different from girders pre-stressed with pre-tensioned internal bonded tendons at corner blisters. Additional HYSD steel reinforcement is required for girders with bonded tendons to deviate the pre-stress force into the cross section. This anchorage zone steel reinforcement can be reduced by minimizing the distance from the anchorage to the junction of the flange and web. The anchorage zone steel reinforcement can also be reduced by increasing the length of the anchorage blister which allows the deviation to occur over a longer distance. An increase in deviation length, however, also increases the moment development length for the global bending resistance of the cross section. The anchorage blister length for continuity tendons is governed by jack clearance requirements for the tendon stressing operation. As a practical limitation, the maximum tendon unit size for use in external post-tensioned bridges is 19 strands of 15mm diameter. Larger tendon units result in an increased demand for local spreading reinforcement which increases congestion of reinforcing bars.

7.5 Economy

Based on material consumption estimations, a large savings in material for the superstructure may be realized for steel trussed bridge construction by adapting a cantilever-constructed box girder design using internal bonded tendons.

In comparison with conventional construction of steel truss bridges in railways, the proposed bridge design consumes 85% approximate for the proposed box girder. The material consumption for the proposed box girder superstructure indicates that a savings in material is possible; however, a full bridge design including abutment and approach materials is necessary to understand the overall savings of this concept.

CHAPTER 8: Conclusion

Generally speaking, when a project comes to an end we feel that what we learned important things from the theme we were studying and with that we can make a difference in the world and help the improvement in our field of studies. With this project it was not different.

Although it was a conceptual study for cantilever constructed concrete bridges, we learned the good design guidelines and tips when projecting a bridge. We also learned the consequences of our possible choices, whether speaking in terms of aesthetics or economy. We were not only able to see and analyze the final results, but also understand how we got there and which factors influenced them the most. Like so, we were able to see that it was the moment caused by the top flange's deadweight which influenced most the total moment caused by the deadweight of the span in the pier section; that, when calculating the total volume of concrete, the volume of the webs was the one that varied the most between the two *h/t* ratios due to the considerable cross section height differences. A fact which was also responsible for the results obtained for the amount of steel.

The main conclusion that we get after finishing this work is that a bridge using a deck in which the cross section height ratio *h/t* is the aesthetically recommended starts to be more expensive as soon as the span surpasses the length of 110m. Moreover, if we choose to build a bridge with a 300m main span, the extra price to make it with the acknowledged design can be too much to justify it, according to some.

When a bridge building decision is being made, engineers follow this basic hierarchy:

- Performance: structural capacity, safety, durability and maintainability;
- Cost: construction and maintenance;
- Appearance

Looking at it we can get the wrong idea that it is not possible to make the best out of every topic without sacrificing any of them. The ideal solution is achieved when all of these topics ate being worked on and improved at the same time. However, we all agree that structural safety is the most important and must never me compromised.

We must not stick to the basic assumptions that limit creativity, such as "The client will never consider a different idea" or "We have always done it this way". The permanent advances in bridge appearance are due to innovations made by engineers who are permanently seeking and trying new materials, new construction techniques and new methods of analysis.

Some examples of this are the bridges designed by the SKYLINE DEVELOPERS as

Beripattan Bridge J & K in the year 2010

Pantang Bridge in Bhutan in the year 2012

and, in our days,

Sadarghat and Badrighat bridges in Silchar Assam in the year 2015

"The future, what does it hold? Nobody knows. The work initiated through the genius of the great constructor Eugène Freyssinet has been continued by his disciples, following on in the footsteps of their master. Many things remain to be done; one in particular, which is continuing in passing the knowledge on to the next generations. However, in order to perpetuate the work achieved, we must keep our technological lead and, wherever possible, increase it".

- Jean Muller

CHAPTER 9: Future Scope

The current work has identified the primary design considerations for longitudinal bending, transverse bending, shear, and anchorage zone detailing. However, additional force effects due to thermal loads and torsion have not been considered in this work. For final design, creep and shrinkage should be considered in a more explicit manner.

SADARGHAT BRIDGE IN SILCHAR ASSAM OVER BARAK RIVER

The existing two lane bridge, 123m central span length, was constructed in 1961 by Gammon India Limited. The Bridge connects Manipur, Dima Hasao district and the airport. It also provides link to NH 53 and NH 54, an access to Mizoram and Imphal. Photographs below show the view of the Bridge. The existing bridge is in major distress and since it's construction, several repair works has been carried out on this bridge. The central hinge is not functioning and the cantilever arms are drooping down which has led to providing a 10m long timber span over the expansion joint over the central hinge.

Other bridge in Silchar with central hinge.

REFERENCES

Journals

1. Byung-Hwan Oh and Se-Jin-Jin Joen
   Realistic Equivalent Load methods in Pre-stressed Concrete Structures (2001)
   (Professors, Department of Civil Engg, Seoul National University, Korea)

2. Chris Burgoyne
   Lessons learned from the bridge collapse in Palau (2008)
   Reader in concrete structures at Cambridge University

3. Kim, Hyung-Tae and Kang, Byung-Seob
   Fabrication and erection of PFCM bridge in Incheon Bridge project (2009)
   a. Yooshin Engineering Corporation

4. R. S. Talikoti
   Seismic analysis of balanced cantilever bridge considering time dependent properties (2014) Department of Civil Engg, Professor, Late G. N. Sapkal College of Engineering, Anjaneri Nashik-422413, Affiliated to Pune University, India

Books

5. Pre-stressed Concrete by T Y Lin
6. Pre-stressed concrete structures by Michael P. Collins and Denis Mitchell
7. Pre-stressed Concrete by N Krishna Raju

Codes

8. IRC 112 Code of practice for concrete road bridges
9. IRC 6–-2014 Standard Specifications and Code of practice for Road Bridges (Load and stresses)
10. IRC 78-2014 Standard Specifications and Code of practice for Road Bridges (Foundation and Substructure)

Software

11. MIDAS
12. OASYS
13. STAAD

Websites:

14. www.infra-transports-materiaux.cerema.fr/IMG/pdf/US_F0308A.
15. www.currentscience.ac.in/Volumes/106/09/1280
16. www.delhimetrorail.com/press_reldetails.

APPENDIX I

Input Data

*** NODE DATA

Node	X(m)	Y(m)	Z(m)
1	0.000000	0.000000	-3.776500
2	0.500000	0.000000	-3.756500
3	1.000000	0.000000	-3.736500
4	4.300000	0.000000	-3.604500
5	7.800000	0.000000	-3.464500
6	11.300000	0.000000	-3.324500
7	14.800000	0.000000	-3.184500
8	18.300000	0.000000	-3.044500
9	21.800000	0.000000	-2.904500
10	25.300000	0.000000	-2.764500
11	28.800000	0.000000	-2.624500
12	32.300000	0.000000	-2.484500
13	35.800000	0.000000	-2.344500
14	39.300000	0.000000	-2.204500
15	42.800000	0.000000	-2.064500
16	45.800000	0.000000	-1.944500
17	48.800000	0.000000	-1.824500
18	51.800000	0.000000	-1.704500
19	54.800000	0.000000	-1.584500
20	57.800000	0.000000	-1.464500
21	60.800000	0.000000	-1.344500
22	61.300000	0.000000	-1.324500
23	61.800000	0.000000	-1.304500
24	64.300000	0.000000	-1.205000
25	66.800000	0.000000	-1.108000
26	67.300000	0.000000	-1.090000
27	67.800000	0.000000	-1.071400
28	70.800000	0.000000	-0.963000
29	73.800000	0.000000	-0.861000
30	76.800000	0.000000	-0.764000
31	79.800000	0.000000	-0.673100
32	82.800000	0.000000	-0.588000
33	85.800000	0.000000	-0.508500
34	89.300000	0.000000	-0.423100
35	92.800000	0.000000	-0.345500
36	96.300000	0.000000	-0.276000
37	99.800000	0.000000	-0.214000
38	103.300000	0.000000	-0.160000
39	106.800000	0.000000	-0.114000
40	110.300000	0.000000	-0.075500
41	113.800000	0.000000	-0.045030

Node	X(m)	Y(m)	Z(m)
42	117.300000	0.000000	-0.022378
43	120.800000	0.000000	0.007566
44	124.300000	0.000000	-0.000594
45	125.662500	0.000000	0.000000
46	127.025000	0.000000	-0.000594
47	130.525000	0.000000	0.007566
48	134.025000	0.000000	-0.022378
49	137.525000	0.000000	-0.045030
50	141.025000	0.000000	-0.075500
51	144.525000	0.000000	-0.114000
52	148.025000	0.000000	-0.160000
53	151.525000	0.000000	-0.214000
54	155.025000	0.000000	-0.276000
55	158.525000	0.000000	-0.345500
56	162.025000	0.000000	-0.423100
57	165.525000	0.000000	-0.508500
58	168.525000	0.000000	-0.588000
59	171.525000	0.000000	-0.673100
60	174.525000	0.000000	-0.764000
61	177.525000	0.000000	-0.861000
62	180.525000	0.000000	-0.963000
63	183.525000	0.000000	-1.071400
64	184.025000	0.000000	-1.090000
65	184.525000	0.000000	-1.108000
66	187.025000	0.000000	-1.205000
67	189.525000	0.000000	-1.304500
68	190.025000	0.000000	-1.324500
69	190.525000	0.000000	-1.344500
70	193.525000	0.000000	-1.464500
71	196.525000	0.000000	-1.584500
72	199.525000	0.000000	-1.704500
73	202.525000	0.000000	-1.824500
74	205.525000	0.000000	-1.944500
75	208.525000	0.000000	-2.064500
76	212.025000	0.000000	-2.204500
77	215.525000	0.000000	-2.344500
78	219.025000	0.000000	-2.484500
79	222.525000	0.000000	-2.624500
80	226.025000	0.000000	-2.764500
81	229.525000	0.000000	-2.904500
82	233.025000	0.000000	-3.044500
83	236.525000	0.000000	-3.184500
84	240.025000	0.000000	-3.324500
85	243.525000	0.000000	-3.464500

Node	X(m)	Y(m)	Z(m)
86	247.025000	0.000000	-3.604500
87	250.325000	0.000000	-3.736500
88	250.825000	0.000000	-3.756500
89	251.325000	0.000000	-3.776500
100	0.500000	2.250000	-7.464000
101	0.500000	2.250000	-7.664000
110	0.500000	-2.250000	-7.464000
111	0.500000	-2.250000	-7.664000
120	250.825000	2.250000	-7.464000
121	250.825000	2.250000	-7.664000
130	250.825000	-2.250000	-7.464000
131	250.825000	-2.250000	-7.664000
200	61.300000	0.000000	-8.824500
201	61.300000	0.000000	-11.424500
202	61.300000	0.000000	-14.024500
203	61.300000	0.000000	-16.624500
204	61.300000	0.000000	-19.224500
205	61.300000	0.000000	-21.824500
210	67.300000	0.000000	-8.590000
211	67.300000	0.000000	-11.190000
212	67.300000	0.000000	-13.790000
213	67.300000	0.000000	-16.390000
214	67.300000	0.000000	-18.990000
215	67.300000	0.000000	-21.590000
220	64.300000	0.000000	-21.707250
300	184.025000	0.000000	-8.590000
301	184.025000	0.000000	-11.190000
302	184.025000	0.000000	-13.790000
303	184.025000	0.000000	-16.390000
304	184.025000	0.000000	-18.990000
305	184.025000	0.000000	-21.590000
310	190.025000	0.000000	-8.824500
311	190.025000	0.000000	-11.424500
312	190.025000	0.000000	-14.024500
313	190.025000	0.000000	-16.624500
314	190.025000	0.000000	-19.224500
315	190.025000	0.000000	-21.824500
320	187.025000	0.000000	-21.707250

BEAM MEMBER DATA

NO	NODAL CONNECTIVITY I	NODAL CONNECTIVITY J	BEAM END RELEASE I	BEAM END RELEASE J	MATERIAL	SECTION	LENGTH
1	1	2	-	-	GIRDER(M50)	Stitch	500.4
2	2	3	-	-	GIRDER(M50)	Stitch	500.4
3	3	4	-	-	GIRDER(M50)	Stitch	3303
4	4	5	-	-	GIRDER(M50)	Stitch	3503
5	5	6	-	-	GIRDER(M50)	Stitch	3503
6	6	7	-	-	GIRDER(M50)	stitch-15	3503
7	7	8	-	-	GIRDER(M50)	seg15-14	3503
8	8	9	-	-	GIRDER(M50)	seg14-13	3503
9	9	10	-	-	GIRDER(M50)	seg13-12	3503
10	10	11	-	-	GIRDER(M50)	seg12-11	3503
11	11	12	-	-	GIRDER(M50)	seg11-10	3503
12	12	13	-	-	GIRDER(M50)	seg10-9	3503
13	13	14	-	-	GIRDER(M50)	seg9-8	3503
14	14	15	-	-	GIRDER(M50)	seg8-7	3503
15	15	16	-	-	GIRDER(M50)	seg7-6	3002
16	16	17	-	-	GIRDER(M50)	seg6-5	3002
17	17	18	-	-	GIRDER(M50)	seg5-4	3002
18	18	19	-	-	GIRDER(M50)	seg4-3	3002
19	19	20	-	-	GIRDER(M50)	seg3-2	3002
20	20	21	-	-	GIRDER(M50)	seg2-1	3002
21	21	22	-	-	GIRDER(M50)	Sec 1	500.4
22	22	23	-	-	GIRDER(M50)	Sec 1	500.4
23	23	24	-	-	GIRDER(M50)	Sec 1	2502
24	24	25	-	-	GIRDER(M50)	Sec 1	2502
25	25	26	-	-	GIRDER(M50)	Sec 1	500.3
26	26	27	-	-	GIRDER(M50)	Sec 1	500.3
27	27	28	-	-	GIRDER(M50)	seg1-2	3002
28	28	29	-	-	GIRDER(M50)	seg2-3	3002
29	29	30	-	-	GIRDER(M50)	seg3-4	3002
30	30	31	-	-	GIRDER(M50)	seg4-5	3001
31	31	32	-	-	GIRDER(M50)	seg5-6	3001
32	32	33	-	-	GIRDER(M50)	seg6-7	3001
33	33	34	-	-	GIRDER(M50)	seg7-8	3501
34	34	35	-	-	GIRDER(M50)	seg8-9	3501
35	35	36	-	-	GIRDER(M50)	seg9-10	3501
36	36	37	-	-	GIRDER(M50)	seg10-11	3501
37	37	38	-	-	GIRDER(M50)	seg11-12	3500
38	38	39	-	-	GIRDER(M50)	seg12-13	3500
39	39	40	-	-	GIRDER(M50)	seg13-14	3500
40	40	41	-	-	GIRDER(M50)	seg14-15	3500
41	41	42	-	-	GIRDER(M50)	seg15-stitch	3500
42	42	43	-	-	GIRDER(M50)	Stitch	3500
43	43	44	-	-	GIRDER(M50)	Stitch	3500
44	44	45	-	-	GIRDER(M50)	Stitch	1363
45	45	46	-	-	GIRDER(M50)	Stitch	1363

46	46	47	-	-	GIRDER(M50)	Stitch	3500
47	47	48	-	-	GIRDER(M50)	Stitch	3500
48	48	49	-	-	GIRDER(M50)	stitch-15	3500
49	49	50	-	-	GIRDER(M50)	seg15-14	3500
50	50	51	-	-	GIRDER(M50)	seg14-13	3500
51	51	52	-	-	GIRDER(M50)	seg13-12	3500
52	52	53	-	-	GIRDER(M50)	seg12-11	3500
53	53	54	-	-	GIRDER(M50)	seg11-10	3501
54	54	55	-	-	GIRDER(M50)	seg10-9	3501
55	55	56	-	-	GIRDER(M50)	seg9-8	3501
56	56	57	-	-	GIRDER(M50)	seg8-7	3501
57	57	58	-	-	GIRDER(M50)	seg7-6	3001
58	58	59	-	-	GIRDER(M50)	seg6-5	3001
59	59	60	-	-	GIRDER(M50)	seg5-4	3001
60	60	61	-	-	GIRDER(M50)	seg4-3	3002
61	61	62	-	-	GIRDER(M50)	seg3-2	3002
62	62	63	-	-	GIRDER(M50)	seg2-1	3002
63	63	64	-	-	GIRDER(M50)	Sec 1	500.3
64	64	65	-	-	GIRDER(M50)	Sec 1	500.3
65	65	66	-	-	GIRDER(M50)	Sec 1	2502
66	66	67	-	-	GIRDER(M50)	Sec 1	2502
67	67	68	-	-	GIRDER(M50)	Sec 1	500.4
68	68	69	-	-	GIRDER(M50)	Sec 1	500.4
69	69	70	-	-	GIRDER(M50)	seg1-2	3002
70	70	71	-	-	GIRDER(M50)	seg2-3	3002
71	71	72	-	-	GIRDER(M50)	seg3-4	3002
72	72	73	-	-	GIRDER(M50)	seg4-5	3002
73	73	74	-	-	GIRDER(M50)	seg5-6	3002
74	74	75	-	-	GIRDER(M50)	seg6-7	3002
75	75	76	-	-	GIRDER(M50)	seg7-8	3503
76	76	77	-	-	GIRDER(M50)	seg8-9	3503
77	77	78	-	-	GIRDER(M50)	seg9-10	3503
78	78	79	-	-	GIRDER(M50)	seg10-11	3503
79	79	80	-	-	GIRDER(M50)	seg11-12	3503
80	80	81	-	-	GIRDER(M50)	seg12-13	3503
81	81	82	-	-	GIRDER(M50)	seg13-14	3503
82	82	83	-	-	GIRDER(M50)	seg14-15	3503
83	83	84	-	-	GIRDER(M50)	seg15-stitch	3503
84	84	85	-	-	GIRDER(M50)	Stitch	3503
85	85	86	-	-	GIRDER(M50)	Stitch	3503
86	86	87	-	-	GIRDER(M50)	Stitch	3303
87	87	88	-	-	GIRDER(M50)	Stitch	500.4
88	88	89	-	-	GIRDER(M50)	Stitch	500.4
200	200	201	-	-	PIER(M50)	PIER_LEFT	2600
201	201	202	-	-	PIER(M50)	PIER_LEFT	2600
202	202	203	-	-	PIER(M50)	PIER_LEFT	2600
203	203	204	-	-	PIER(M50)	PIER_LEFT	2600
204	204	205	-	-	PIER(M50)	PIER_LEFT	2600
210	210	211	-	-	PIER(M50)	PIER_RIGHT	2600
211	211	212	-	-	PIER(M50)	PIER_RIGHT	2600
212	212	213	-	-	PIER(M50)	PIER_RIGHT	2600
213	213	214	-	-	PIER(M50)	PIER_RIGHT	2600
214	214	215	-	-	PIER(M50)	PIER_RIGHT	2600

300	300	301	-	-	PIER(M50)	PIER_LEFT	2600
301	301	302	-	-	PIER(M50)	PIER_LEFT	2600
302	302	303	-	-	PIER(M50)	PIER_LEFT	2600
303	303	304	-	-	PIER(M50)	PIER_LEFT	2600
304	304	305	-	-	PIER(M50)	PIER_LEFT	2600
310	310	311	-	-	PIER(M50)	PIER_RIGHT	2600
311	311	312	-	-	PIER(M50)	PIER_RIGHT	2600
312	312	313	-	-	PIER(M50)	PIER_RIGHT	2600
313	313	314	-	-	PIER(M50)	PIER_RIGHT	2600
314	314	315	-	-	PIER(M50)	PIER_RIGHT	2600

BOUNDARIES

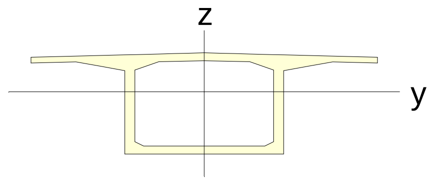
Node	Dx	Dy	Dz	Rx	Ry	Rz	Group
101	1	1	1	1	1	1	A1 SUPPORT
111	1	1	1	1	1	1	A1 SUPPORT
121	1	1	1	1	1	1	A2 SUPPORT
131	1	1	1	1	1	1	A2 SUPPORT
220	1	1	1	1	1	1	PIER SUPPORT
320	1	1	1	1	1	1	PIER SUPPORT

No	Node1	Node2	Type	B Angle ([deg])	SDx (tonf/m)	SDy (tonf/m)	SDz (tonf/m)	SRx (tonf·m/[rad])	SRy (tonf·m/[rad])	SRz (tonf·m/[rad])	Shear Spring Location	Distance Ratio SDy	Distance Ratio SDz	Group
1	100	101	GEN	0.00	1019720.0000	0.0000	0.0000	0.00	0.00	0.00	X	0.50	0.50	A1 SUPPORT
2	110	111	GEN	0.00	1019720.0000	1019720.0000	0.0000	0.00	0.00	0.00	X	0.50	0.50	A1 SUPPORT
3	120	121	GEN	0.00	1019720.0000	0.0000	0.0000	0.00	0.00	0.00	X	0.50	0.50	A2 SUPPORT
4	130	131	GEN	0.00	1019720.0000	1019720.0000	0.0000	0.00	0.00	0.00	X	0.50	0.50	A2 SUPPORT

M-Node	Type	Slave Node List	Group
2	111111	100 110	A1_BG
22	111111	200	PIER_SEG1_BG
26	111111	210	PIER_SEG1_BG
64	111111	300	PIER_SEG2_BG
68	111111	310	PIER_SEG2_BG
88	111111	120 130	A2_BG
220	111111	205 215	PIER_SEG1_BG
320	111111	305 315	PIER_SEG2_BG

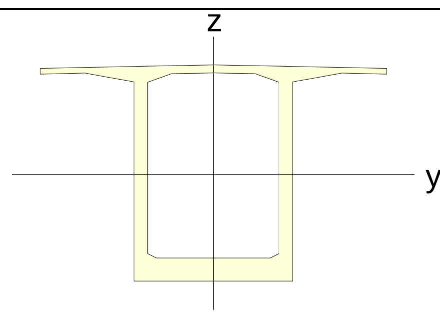
CROSS SECTION PROPERTIES

Table 1 1 : Stitch



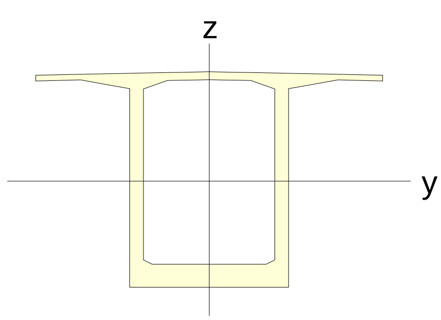
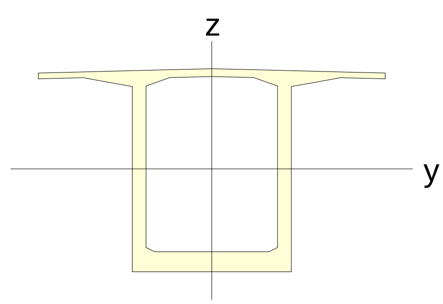
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
7184564.750	4251332.245	1963981.151	1348.280	2152.430
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
22030227120993.344	12586129441473.930	54917724190859.398	6000.000	6000.000

Table 2 16 : Sec 1



A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
14054433.500	5444126.792	6428265.745	3789.803	3678.907
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
102363099622356.640	114323909374440.230	86026529323281.281	6000.000	6000.000

Table 3 18 : seg1-2

I-End					J-End				
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)

14054433.500	5444126.792	6428265.745	3789.803	3678.907	13173822.550	5227549.562	5991209.299	3467.129	3561.581
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
102363099622356.640	114323909374440.230	86026529323281.281	6000.000	6000.000	91759710960508.391	94897333165253.687	83224389240989.656	6000.000	6000.000

Table 4 19 : seg2-3

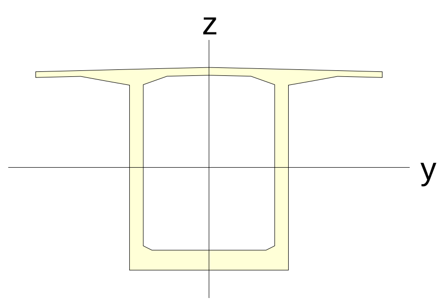
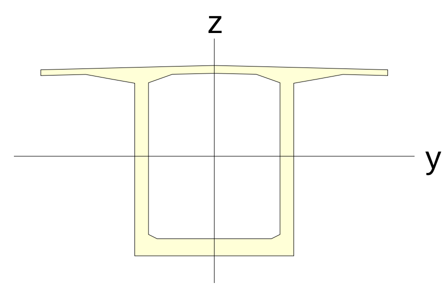
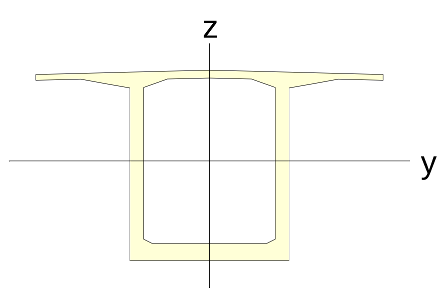
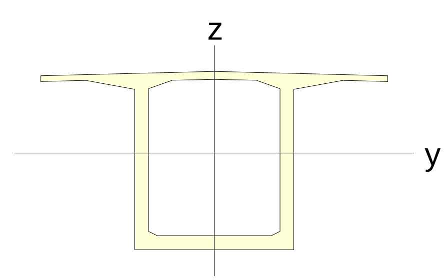
I-End					J-End				
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
13173822.550	5227549.562	5991209.299	3467.129	3561.581	12277008.250	5006983.563	5561324.732	3141.855	3445.855
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
91759710960508.391	94897333165253.687	83224389240989.656	6000.000	6000.000	81747146140256.297	77552751546271.703	79742546334739.578	6000.000	6000.000

Table 5 20 : seg3-4

I-End					J-End				
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
12277008	5006983.	5561324.	314	344	11409001	4750063.	5162373.	282	334

.250	563	732	1.855	5.855	.500	666	504	8.485	8.225
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
81747146140256.297	77552751546271.703	79742546334739.578	6000.000	6000.000	71952815068250.578	62772123360445.250	76454765485781.266	6000.000	6000.000

Table 6 21 : seg4-5

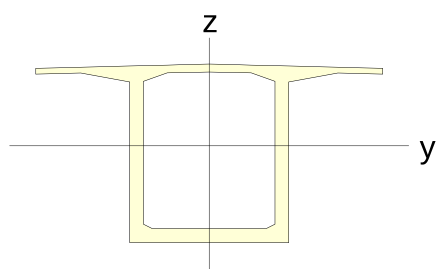
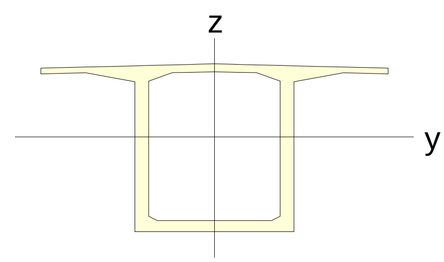
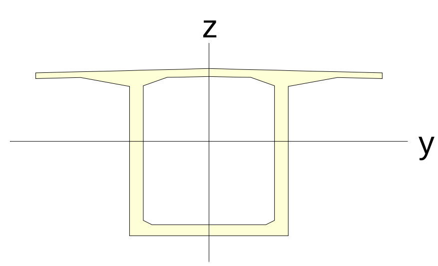
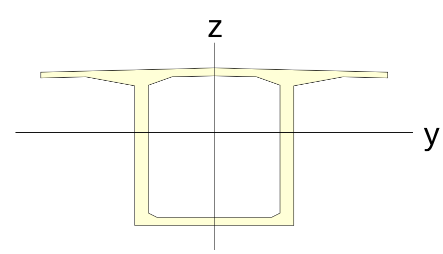
I-End					J-End				
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
11409001.500	4750063.666	5162373.504	2828.485	3348.225	10568352.450	4441429.751	4796455.995	2524.589	3270.121
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
71952815068250.578	62772123360445.250	76454765485781.266	6000.000	6000.000	62312453898759.086	50126005011386.383	73332903032656.312	6000.000	6000.000

Table 7 22 : seg5-6

I-End					J-End				
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
10568352.450	4441429.751	4796455.995	2524.589	3270.121	9755061.000	4049998.954	4442784.487	2227.674	3214.036
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+	y(-	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+	y(-

			)(mm)	)(mm)				)(mm)	)(mm)
62312453898759.086	50126005011386.383	73332903032656.312	6000.000	6000.000	52063426235480.195	39246033119191.156	70376954548281.312	6000.000	6000.000

Table 8 23 : seg6-7

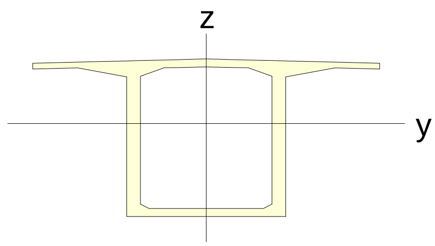
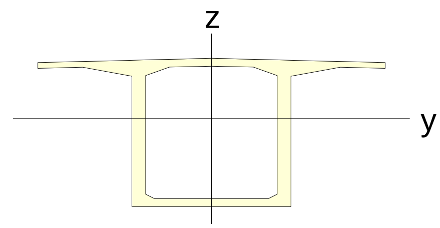
I-End					J-End				
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
9755061.000	4049998.954	4442784.487	2227.674	3214.036	9448327.150	4094763.571	4137646.075	2084.247	3034.463
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
52063426235480.195	39246033119191.156	70376954548281.312	6000.000	6000.000	46944369622668.937	33752985870483.215	68439288615989.602	6000.000	6000.000

Table 9 24 : seg7-8

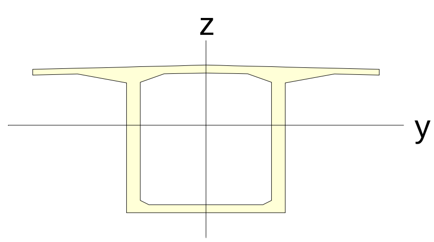
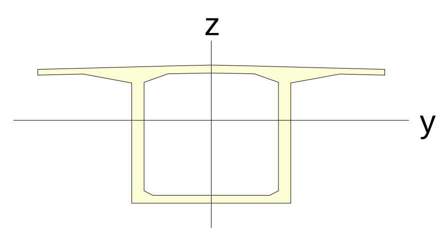
I-End					J-End				
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
9448327.150	4094763.571	4137646.075	2084.247	3034.463	8708422.300	4115928.637	3442637.461	1912.175	2867.535
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
46944369622668.937	33752985870483.215	68439288615989.602	6000.000	6000.000	40361916958844.086	27796279494757.613	64264495447239.656	6000.000	6000.000

Table 10 25 : seg8-9

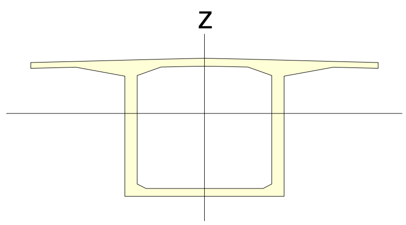
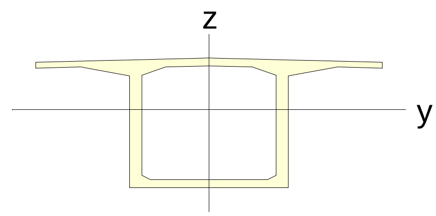
I-End					J-End				
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
8708422.300	4115928.637	3442637.461	1912.175	2867.535	8453407.000	4146020.615	3168467.140	1783.218	2696.492
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
40361916958844.086	27796279494757.613	64264495447239.656	6000.000	6000.000	35894873193498.094	23726629355264.129	62618058728489.602	6000.000	6000.000

Table 11 26 : seg9-10

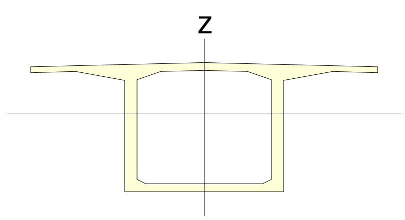
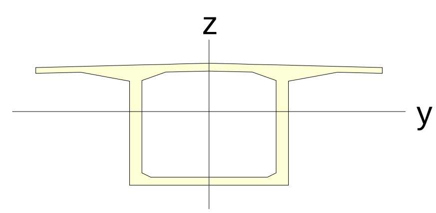
I-End					J-End				
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
8453407.000	4146020.615	3168467.140	1783.218	2696.492	8232393.750	4184716.893	2944286.491	1672.509	2547.201
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
35894873193498.094	23726629355264.129	62618058728489.602	6000.000	6000.000	32342814214082.680	20501293662956.371	61191147348281.211	6000.000	6000.000

Table 12 27 : seg10-11

I-End	J-End

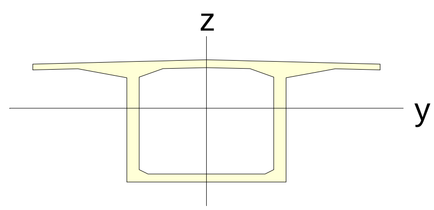
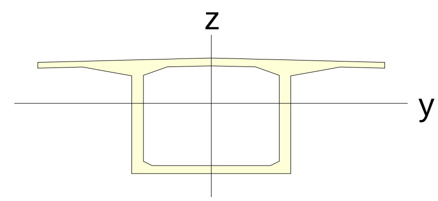
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
8232393.750	4184716.893	2944286.491	1672.509	2547.201	7873663.750	4201116.565	2609568.731	1570.328	2429.382
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
32342814214082.680	20501293662956.371	61191147348281.211	6000.000	6000.000	28934473634490.961	17783846313549.176	59078638683203.078	6000.000	6000.000

Table 13 28 : seg11-12

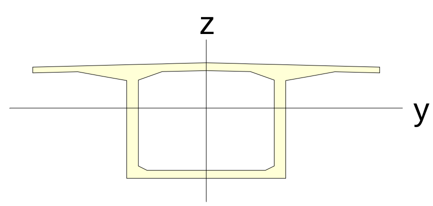
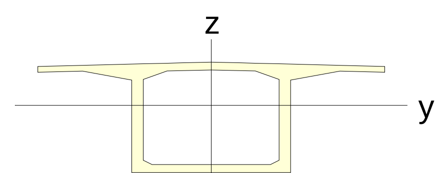
I-End					J-End				
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
7873663.750	4201116.565	2609568.731	1570.328	2429.382	7729654.550	4223135.074	2462167.649	1495.597	2324.113
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
28934473634490.961	17783846313549.176	59078638683203.078	6000.000	6000.000	26634120088035.887	15895125537761.445	58139951391536.430	6000.000	6000.000

Table 14 29 : seg12-13

I-End	J-End

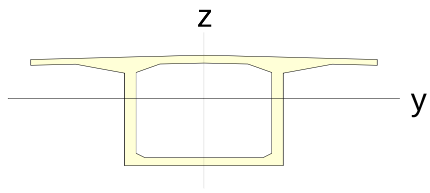
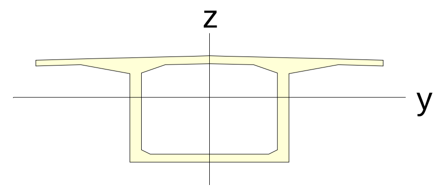
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
7729654.550	4223135.074	2462167.649	1495.597	2324.113	7616789.450	4243846.926	2350642.873	1437.490	2241.560
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
26634120088035.887	15895125537761.445	58139951391536.430	6000.000	6000.000	24911818130232.012	14506314821879.158	57391814000286.469	6000.000	6000.000

Table 15 30 : seg13-14

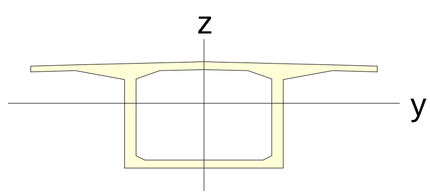
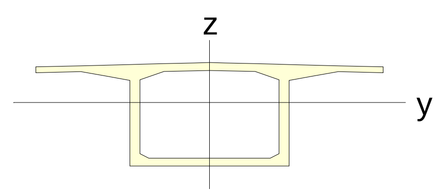
I-End					J-End				
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
7616789.450	4243846.926	2350642.873	1437.490	2241.560	7240629.850	4242336.879	2022325.234	1380.310	2200.400
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
24911818130232.012	14506314821879.158	57391814000286.469	6000.000	6000.000	22966950108163.469	13295417473786.906	55290902311692.727	6000.000	6000.000

Table 16 31 : seg14-15

I-End	J-End

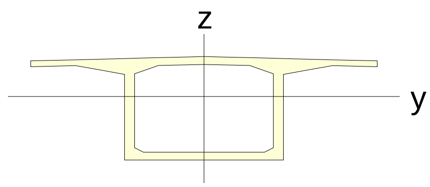
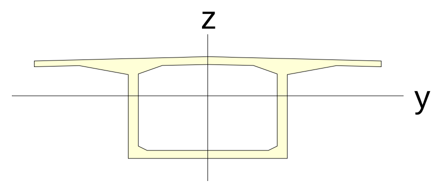
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
7240629.850	4242336.879	2022325.234	1380.310	2200.400	7197774.750	4248959.194	1977802.259	1355.853	2164.147
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
22966950108163.469	13295417473786.906	55290902311692.727	6000.000	6000.000	22250190536894.316	12757675058186.330	54992833432109.391	6000.000	6000.000

Table 17 32 : seg15-stitch

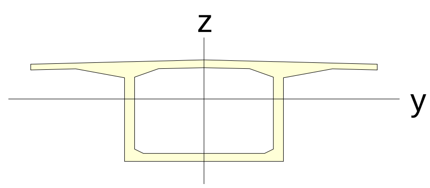
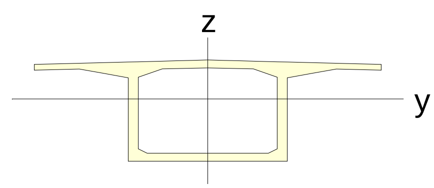
I-End					J-End				
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
7197774.750	4248959.194	1977802.259	1355.853	2164.147	7184564.750	4251332.245	1963981.151	1348.280	2152.430
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
22250190536894.316	12757675058186.330	54992833432109.391	6000.000	6000.000	22030227120993.344	12586129441473.930	54917724190859.398	6000.000	6000.000

Table 18 33 : seg2-1

I-End	J-End

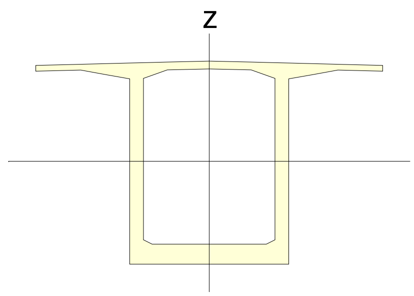
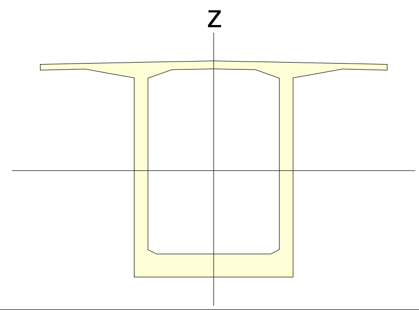
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
13173822.550	5227549.562	5991209.299	3467.129	3561.581	14054433.500	5444126.792	6428265.745	3789.803	3678.907
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
91759710960508.391	94897333165253.687	83224389240989.656	6000.000	6000.000	102363099622356.640	114323909374440.230	86026529323281.281	6000.000	6000.000

Table 19 34 : seg3-2

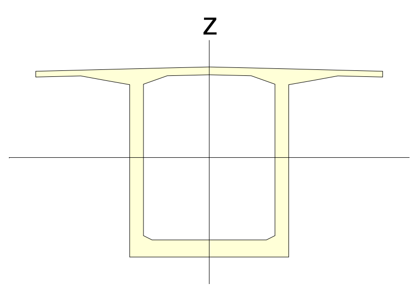
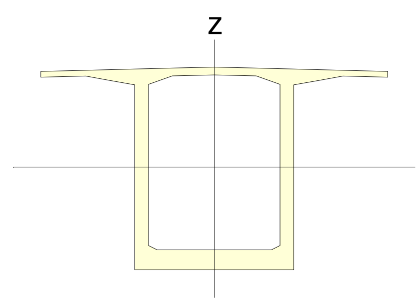
I-End					J-End				
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
12277008.250	5006983.563	5561324.732	3141.855	3445.855	13173822.550	5227549.562	5991209.299	3467.129	3561.581
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
81747146140256.297	77552751546271.703	79742546334739.578	6000.000	6000.000	91759710960508.391	94897333165253.687	83224389240989.656	6000.000	6000.000

Table 20 35 : seg4-3

I-End	J-End

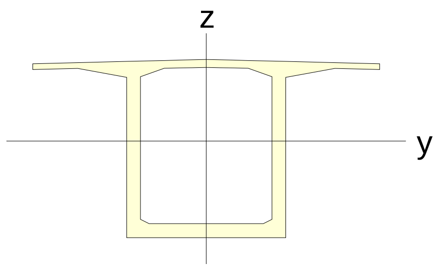
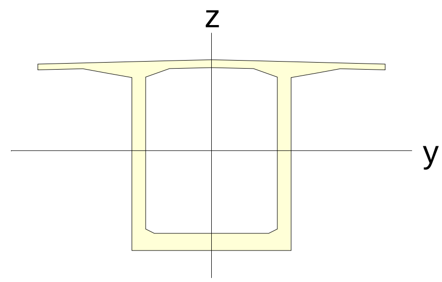
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
11409001.500	4750063.666	5162373.504	2828.485	3348.225	12277008.250	5006983.563	5561324.732	3141.855	3445.855
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
71952815068250.578	62772123360445.250	76454765485781.266	6000.000	6000.000	81747146140256.297	77552751546271.703	79742546334739.578	6000.000	6000.000

Table 21 36 : seg5-4

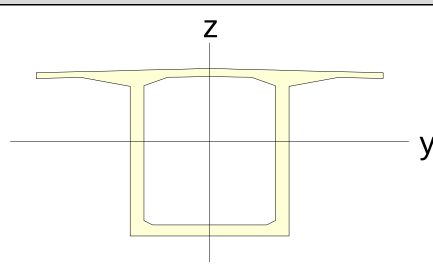
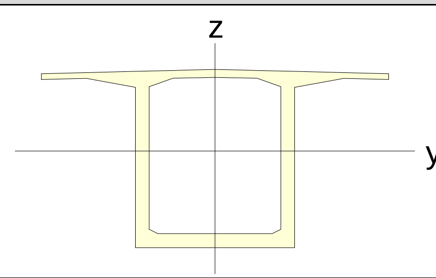
I-End					J-End				
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
10568352.450	4441429.751	4796455.995	2524.589	3270.121	11409001.500	4750063.666	5162373.504	2828.485	3348.225
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
62312453898759.086	50126005011386.383	73332903032656.312	6000.000	6000.000	71952815068250.578	62772123360445.250	76454765485781.266	6000.000	6000.000

Table 22 37 : seg6-5

I-End	J-End

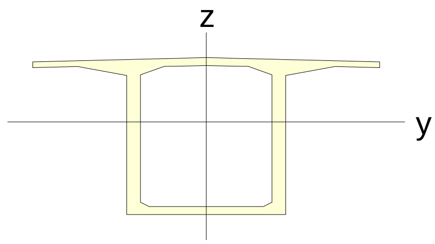
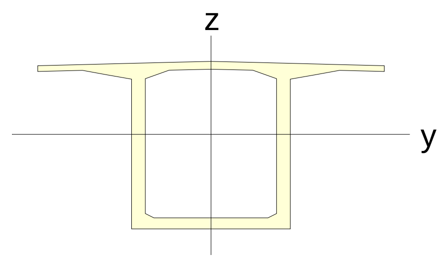
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
9755061.000	4049998.954	4442784.487	2227.674	3214.036	10568352.450	4441429.751	4796455.995	2524.589	3270.121
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
52063426235480.195	39246033119191.156	70376954548281.312	6000.000	6000.000	62312453898759.086	50126005011386.383	73332903032656.312	6000.000	6000.000

Table 23 38 : seg7-6

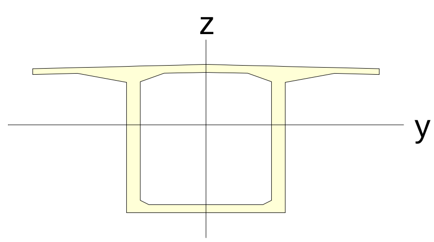
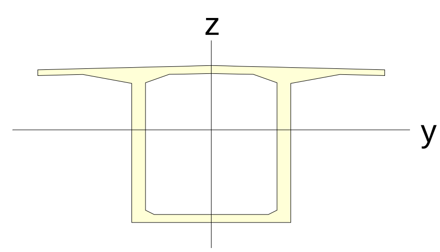
I-End					J-End				
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
9448327.150	4094763.571	4137646.075	2084.247	3034.463	9755061.000	4049998.954	4442784.487	2227.674	3214.036
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
46944369622668.937	33752985870483.215	68439288615989.602	6000.000	6000.000	52063426235480.195	39246033119191.156	70376954548281.312	6000.000	6000.000

Table 24 39 : seg8-7

I-End	J-End

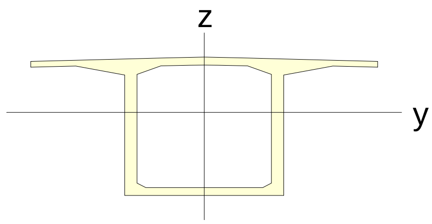
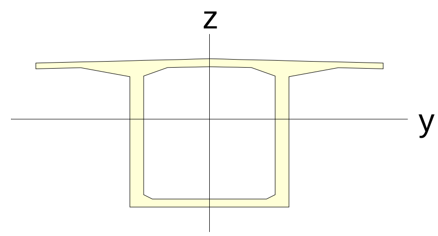
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
8708422.300	4115928.637	3442637.461	1912.175	2867.535	9448327.150	4094763.571	4137646.075	2084.247	3034.463
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
40361916958844.086	27796279494757.613	64264495447239.656	6000.000	6000.000	46944369622668.937	33752985870483.215	68439288615989.602	6000.000	6000.000

Table 25 40 : seg9-8

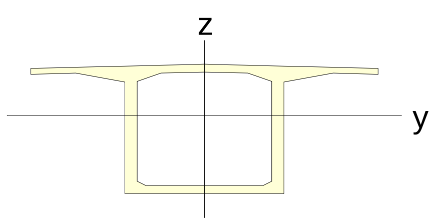
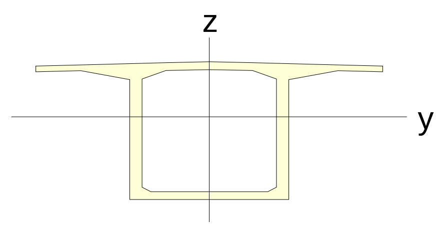
I-End					J-End				
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
8453407.000	4146020.615	3168467.140	1783.218	2696.492	8708422.300	4115928.637	3442637.461	1912.175	2867.535
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
35894873193498.094	23726629355264.129	62618058728489.602	6000.000	6000.000	40361916958844.086	27796279494757.613	64264495447239.656	6000.000	6000.000

Table 26 41 : seg10-9

I-End	J-End

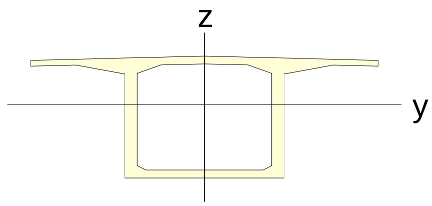
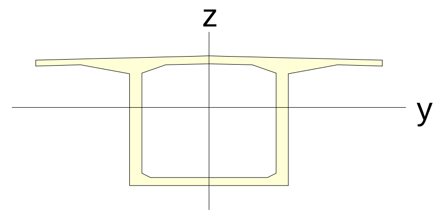
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
8232393.750	4184716.893	2944286.491	1672.509	2547.201	8453407.000	4146020.615	3168467.140	1783.218	2696.492
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
32342814214082.680	20501293662956.371	61191147348281.211	6000.000	6000.000	35894873193498.094	23726629355264.129	62618058728489.602	6000.000	6000.000

Table 27 42 : seg11-10

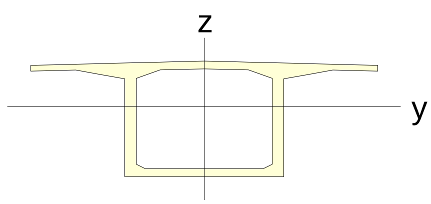
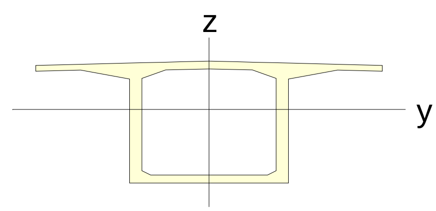
I-End					J-End				
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
7873663.750	4201116.565	2609568.731	1570.328	2429.382	8232393.750	4184716.893	2944286.491	1672.509	2547.201
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
28934473634490.961	17783846313549.176	59078638683203.078	6000.000	6000.000	32342814214082.680	20501293662956.371	61191147348281.211	6000.000	6000.000

Table 28 43 : seg12-11

I-End	J-End

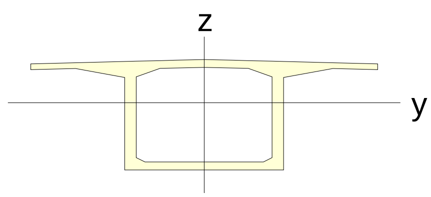
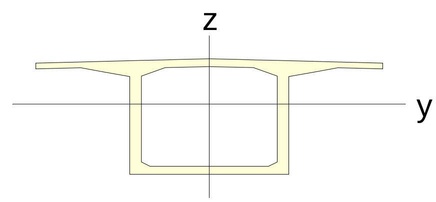
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
7729654.550	4223135.074	2462167.649	1495.597	2324.113	7873663.750	4201116.565	2609568.731	1570.328	2429.382
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
26634120088035.887	15895125537761.445	58139951391536.430	6000.000	6000.000	28934473634490.961	17783846313549.176	59078638683203.078	6000.000	6000.000

Table 29 44 : seg13-12

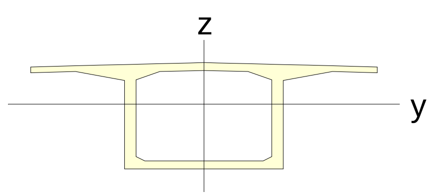
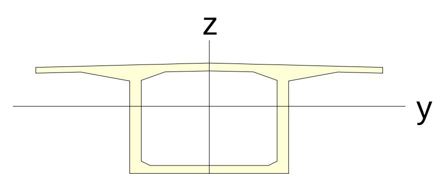
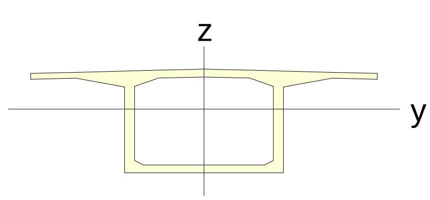
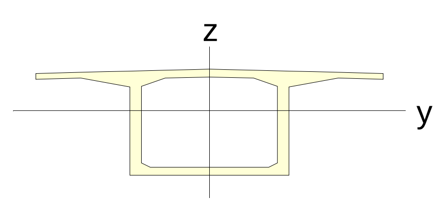
I-End					J-End				
									
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)	A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
7616789.450	4243846.926	2350642.873	1437.490	2241.560	7729654.550	4223135.074	2462167.649	1495.597	2324.113
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
24911818130232.012	14506314821879.158	57391814000286.469	6000.000	6000.000	26634120088035.887	15895125537761.445	58139951391536.430	6000.000	6000.000

Table 30 45 : seg14-13

I-End					J-End				
									

A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
7240629.850	4242336.879	2022325.234	1380.310	2200.400	7616789.450	4243846.926	2350642.873	1437.490	2241.560
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
22966950108163.469	13295417473786.906	55290902311692.727	6000.000	6000.000	24911818130232.012	14506314821879.158	57391814000286.469	6000.000	6000.000

Table 31 46 : seg15-14

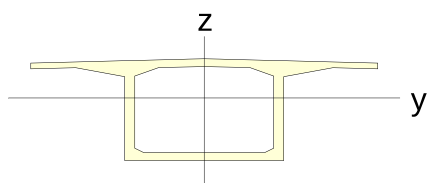
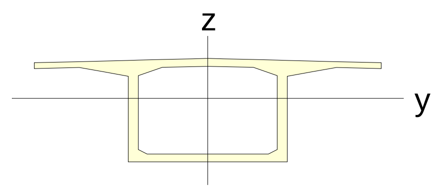
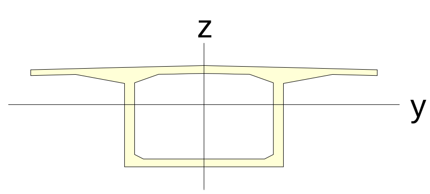
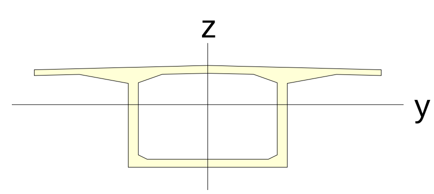
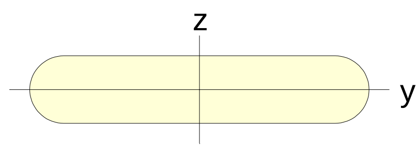
I-End					J-End				
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
7197774.750	4248959.194	1977802.259	1355.853	2164.147	7240629.850	4242336.879	2022325.234	1380.310	2200.400
Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)	Ixx(mm^4)	Iyy(mm^4)	Izz(mm^4)	y(+)(mm)	y(-)(mm)
22250190536894.316	12757675058186.330	54992833432109.391	6000.000	6000.000	22966950108163.469	13295417473786.906	55290902311692.727	6000.000	6000.000

Table 32 47 : stitch-15

I-End					J-End				
									
A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)	A(mm^2)	Asy(mm^2)	Asz(mm^2)	z(+)(mm)	z(-)(mm)
7184564.750	4251332.245	1963981.151	1348.280	2152.430	7197774.750	4248959.194	1977802.259	1355.853	2164.147

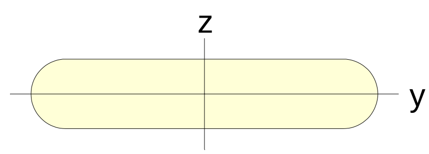
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)	Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
22030227120993.344	12586129441473.930	54917724190859.398	6000.000	6000.000	22250190536894.316	12757675058186.330	54992833432109.391	6000.000	6000.000

Table 33 48 : PIER_LEFT



A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
5790331.778	5695298.600	4888631.933	550.000	550.000
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
2028021675098.926	559902174022.721	13456074644810.211	2750.000	2750.000

Table 34 49 : PIER_RIGHT

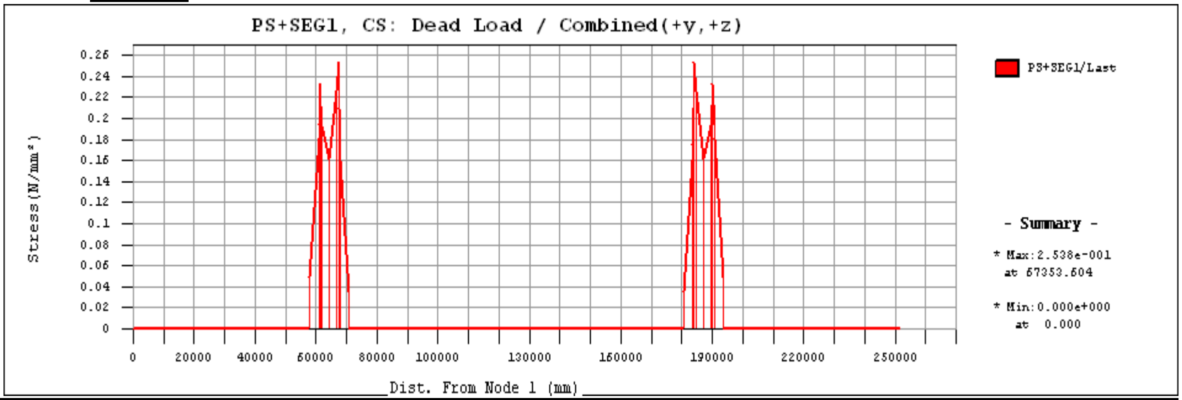


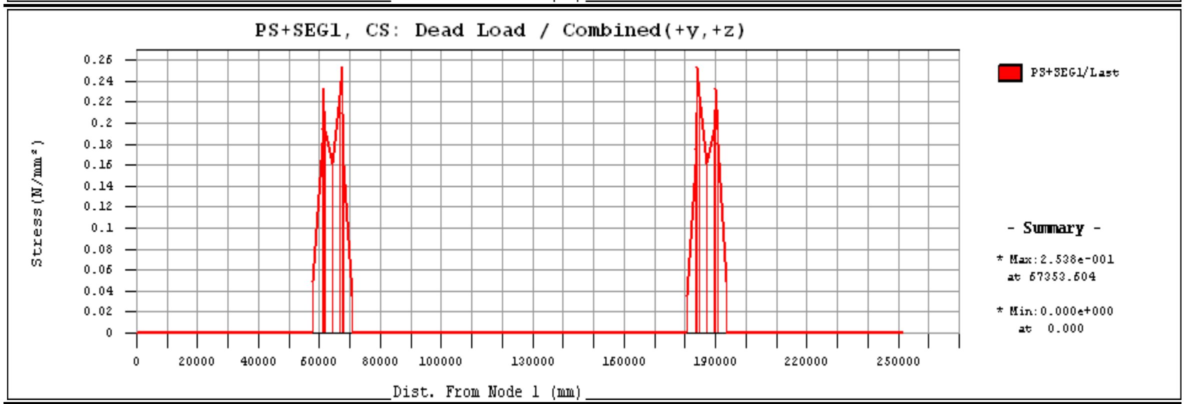
A(mm ^{2})	Asy(mm ^{2})	Asz(mm ^{2})	z(+)(mm)	z(-)(mm)
5790331.778	5695298.600	4888631.933	550.000	550.000
Ixx(mm ^{4})	Iyy(mm ^{4})	Izz(mm ^{4})	y(+)(mm)	y(-)(mm)
2028021675098.926	559902174022.721	13456074644810.211	2750.000	2750.000

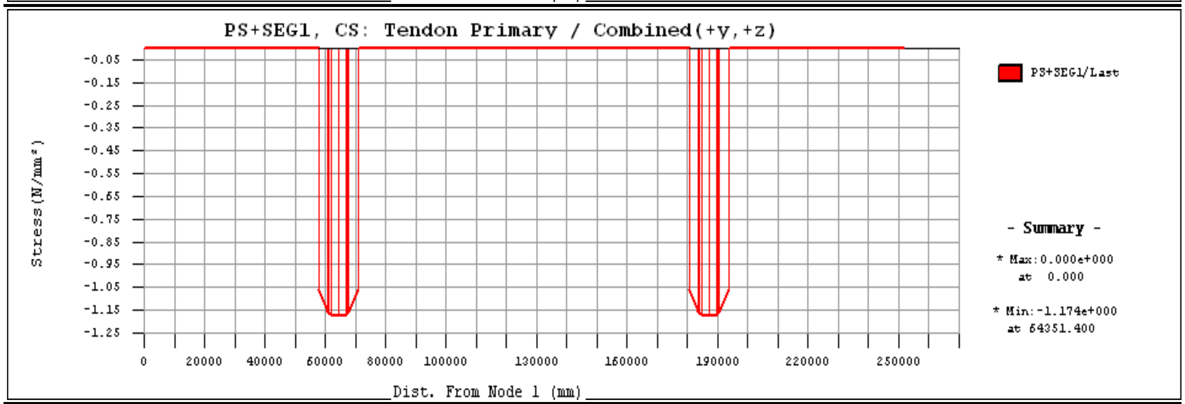
APPENDIX II Construction stage Analysis (Stress diagrams)

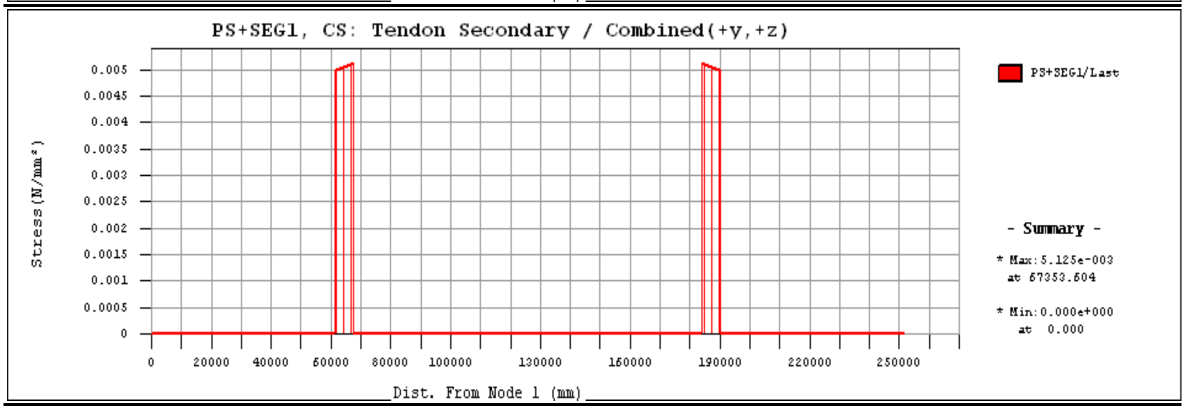
STRESS DIAGRAM FOR TOP FIBRE AT DIFFERENT SEGMENTS

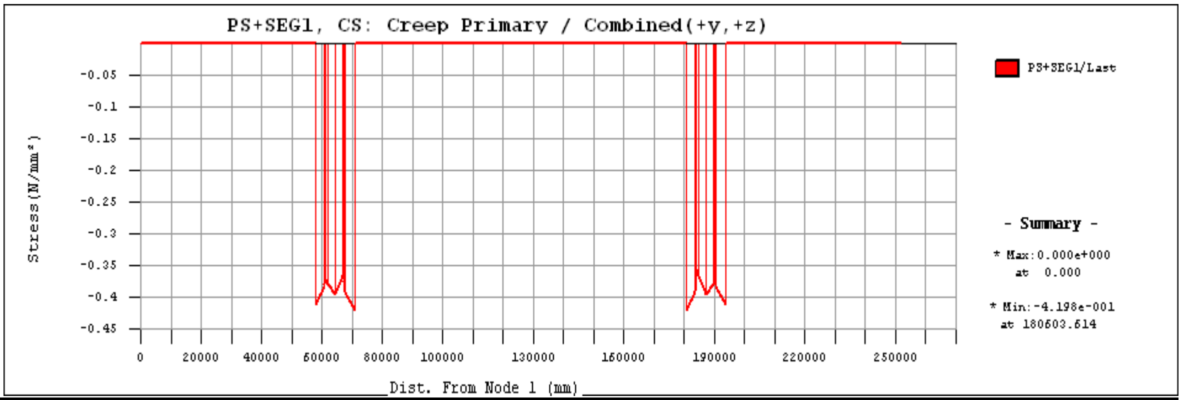
PS SEG 1

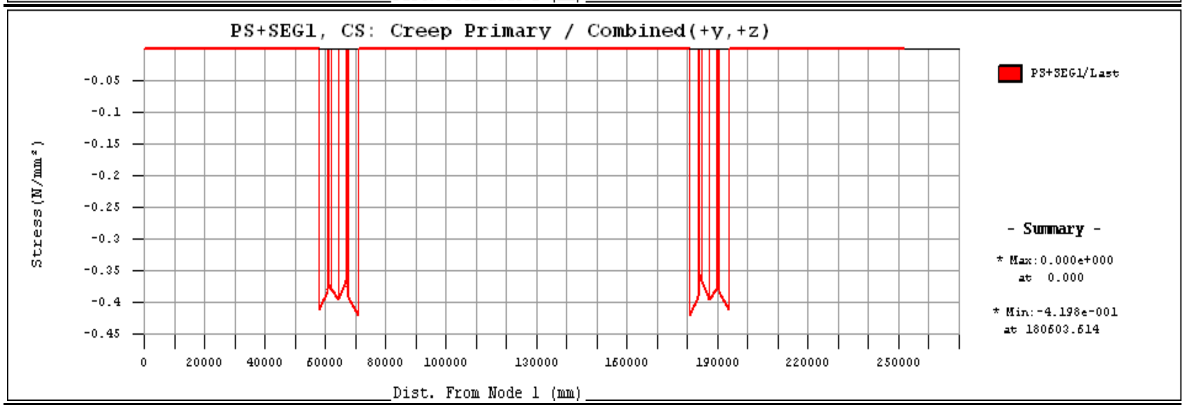


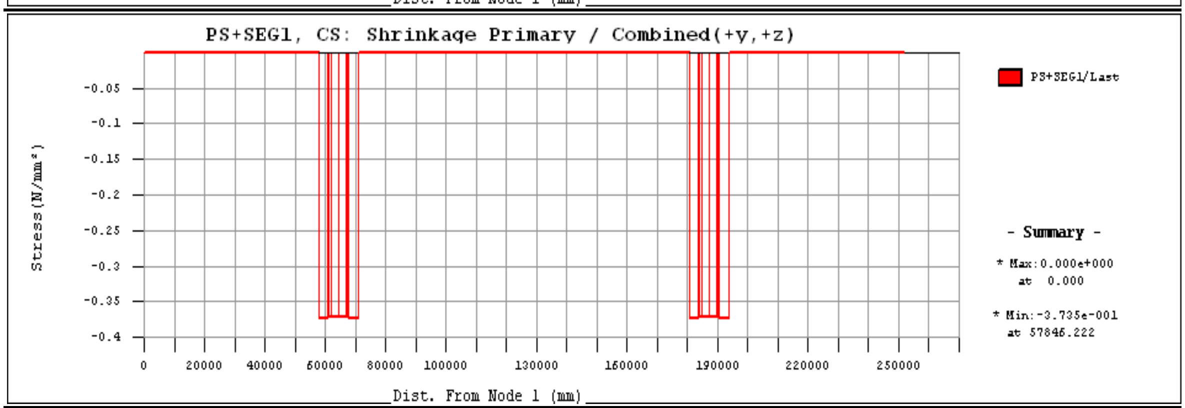


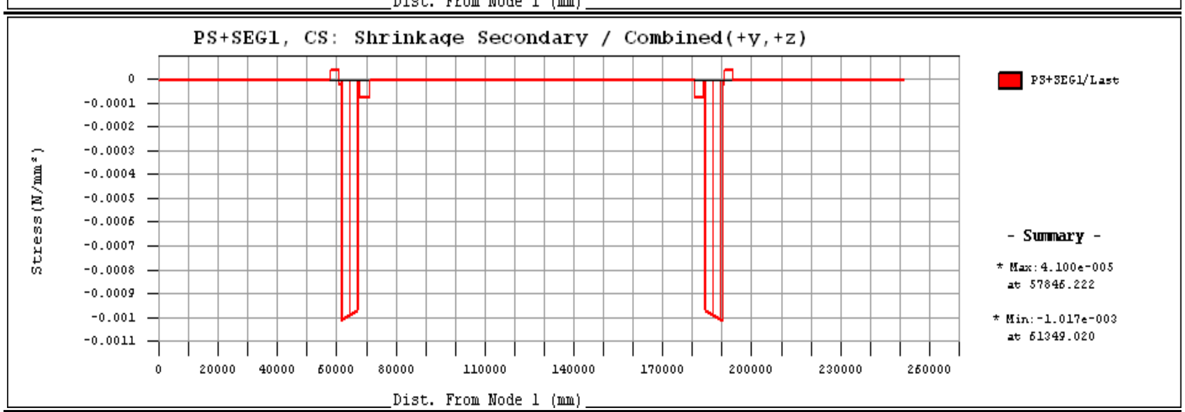


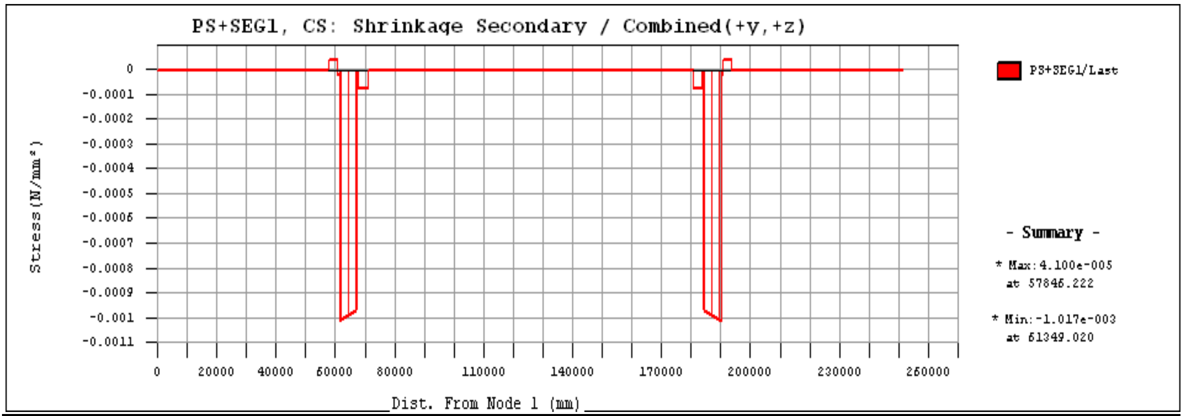



PS+SEG1, CS: Creep Primary / Combined(+y,+z)
PS+SEG1/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-4.198e-001
at 180603.614

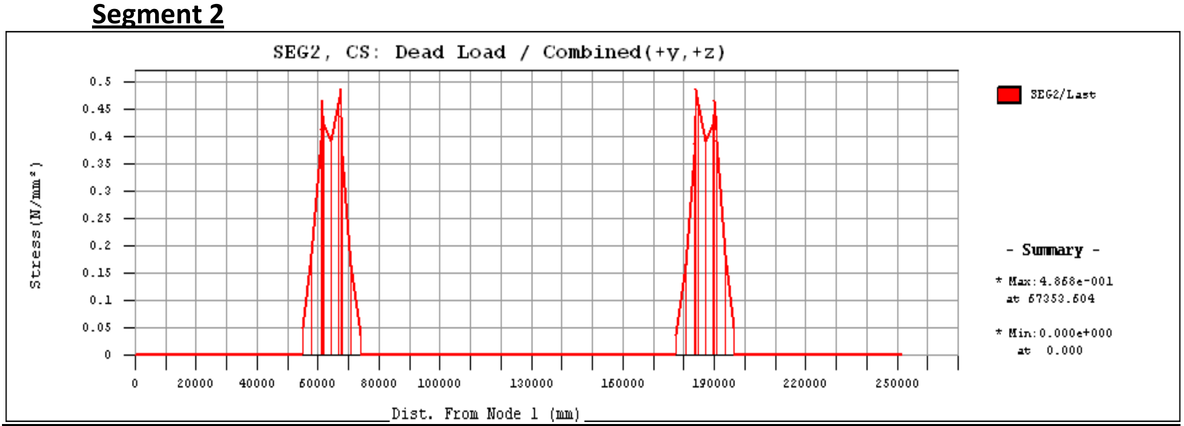

PS+SEG1, CS: Creep Primary / Combined(+y,+z)
PS+SEG1/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-4.198e-001
at 180603.614

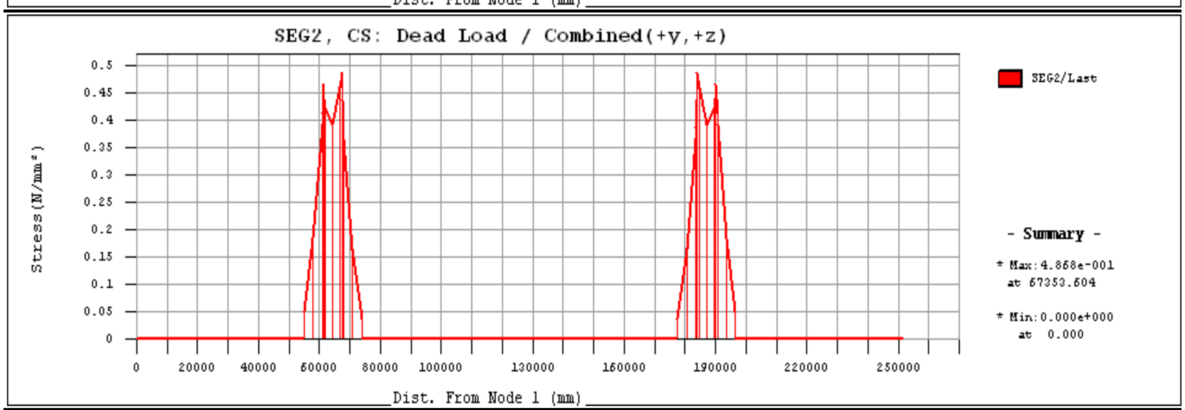

PS+SEG1, CS: Shrinkage Primary / Combined(+y,+z)
PS+SEG1/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-3.735e-001
at 57846.222

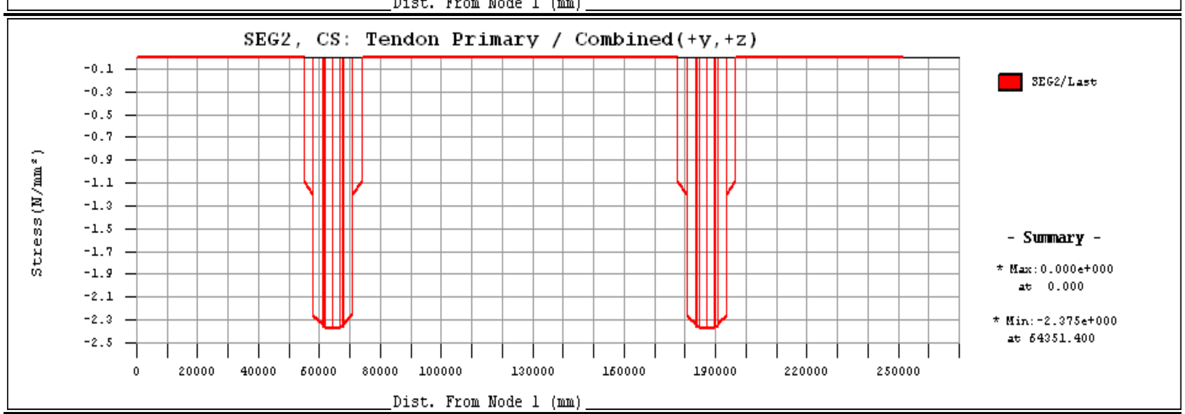

PS+SEG1, CS: Shrinkage Secondary / Combined(+y,+z)
PS+SEG1/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:4.100e-005
at 57846.222
* Min:-1.017e-003
at 61349.020

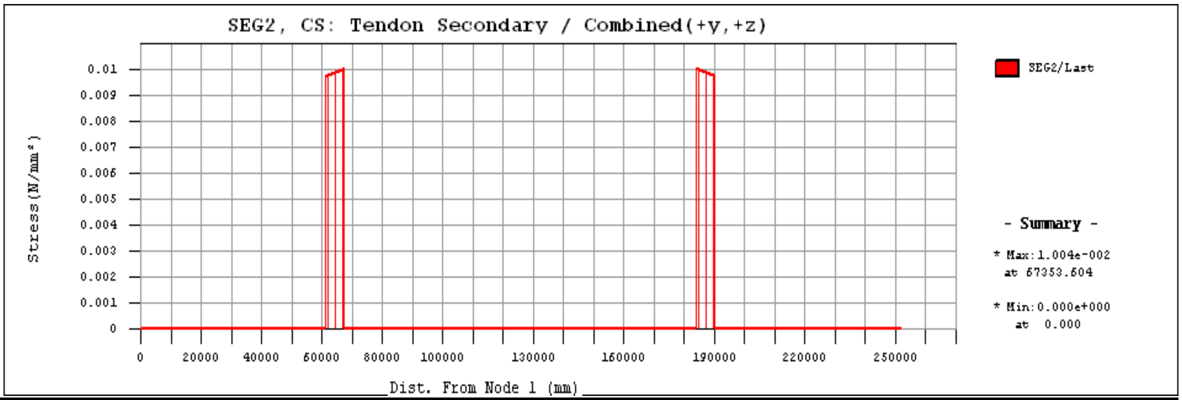

PS+SEG1, CS: Shrinkage Secondary / Combined(+y,+z)
PS+SEG1/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:4.100e-005
at 57846.222
* Min:-1.017e-003
at 61349.020

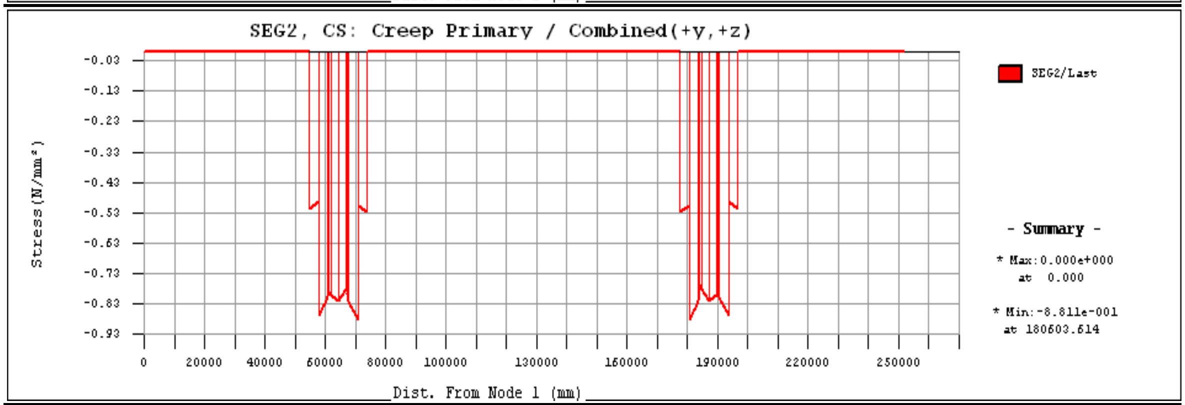
Segment 2

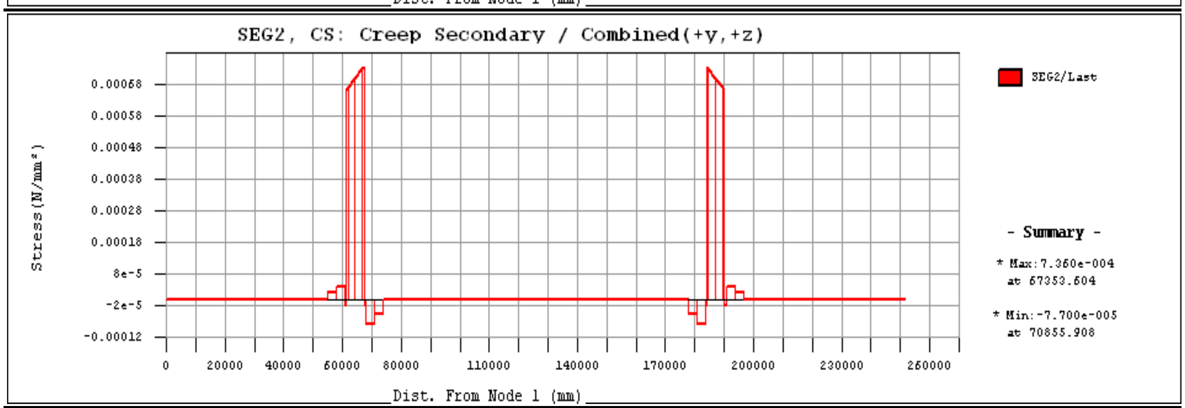

SEG2, CS: Dead Load / Combined(+y,+z)
SEG2/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:4.868e-001
at 67353.604
* Min:0.000e+000
at 0.000

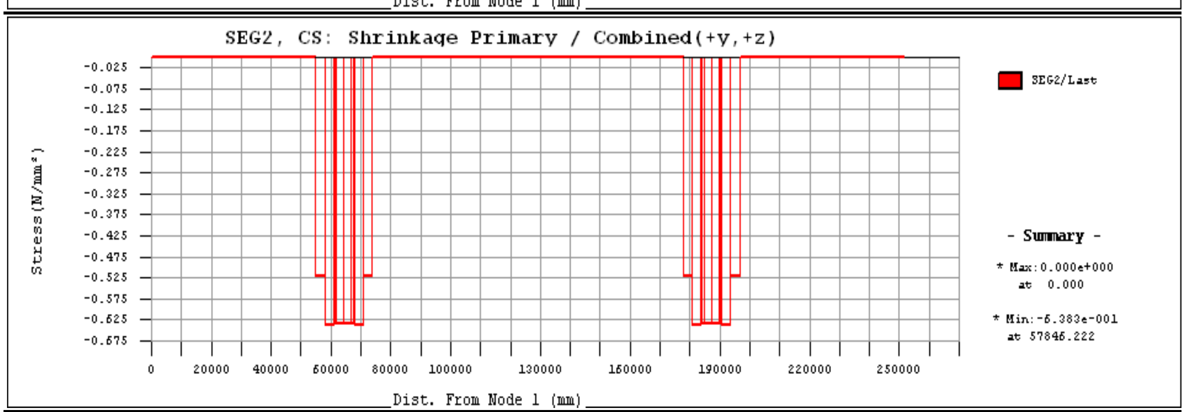

SEG2, CS: Dead Load / Combined(+y,+z)
SEG2/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:4.868e-001
at 67353.604
* Min:0.000e+000
at 0.000

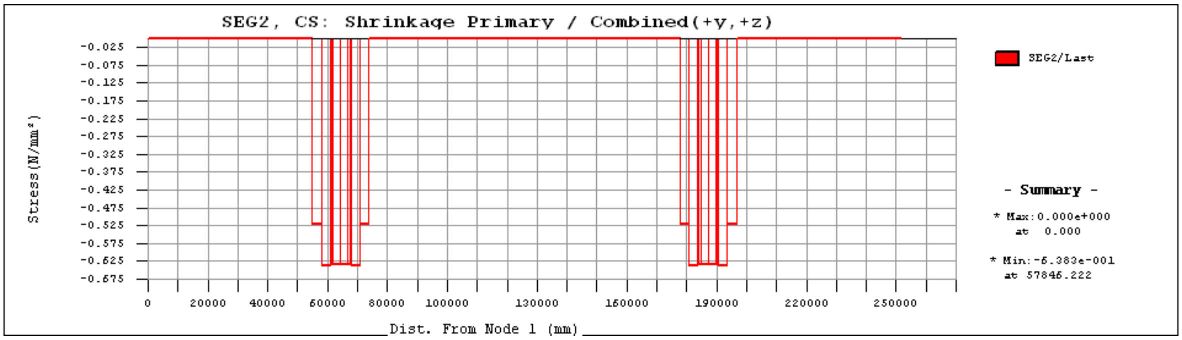

SEG2, CS: Tendon Primary / Combined(+y,+z)
SEG2/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.375e+000
at 64351.400

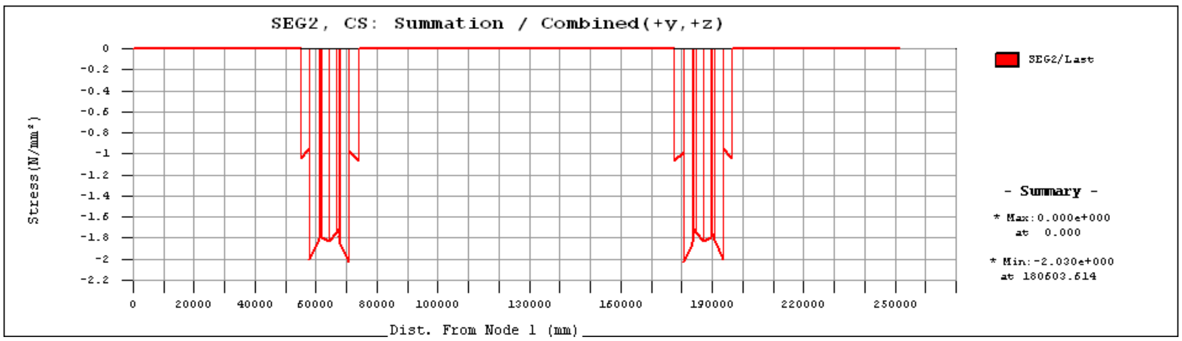

SEG2, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:1.004e-002
at 67353.604
* Min:0.000e+000
at 0.000


SEG2, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-8.811e-001
at 180603.614

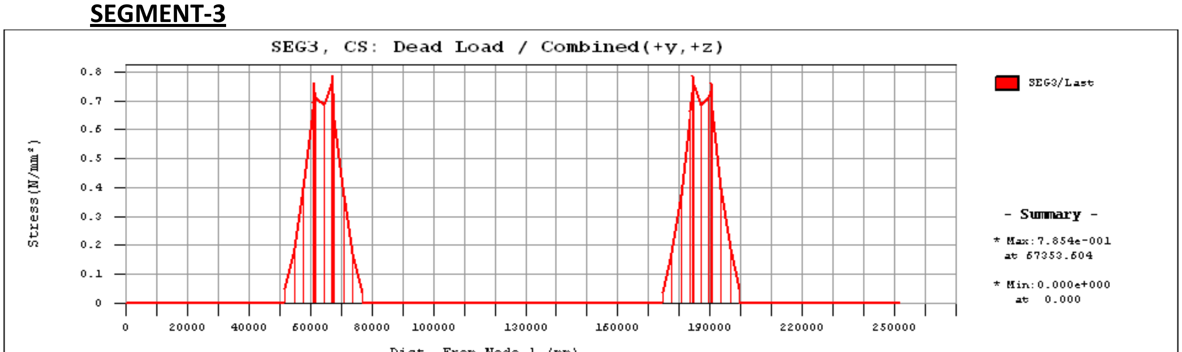

SEG2, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:7.350e-004
at 67353.604
* Min:-7.700e-005
at 70855.908

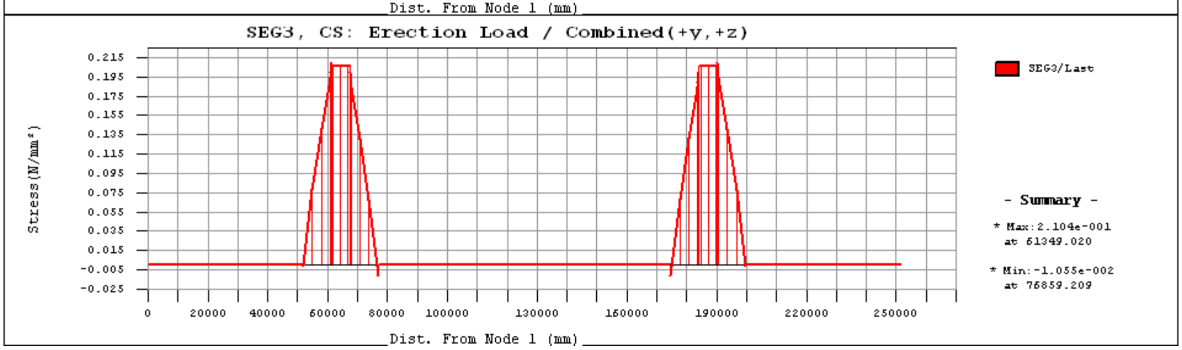

SEG2, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-6.383e-001
at 57846.222

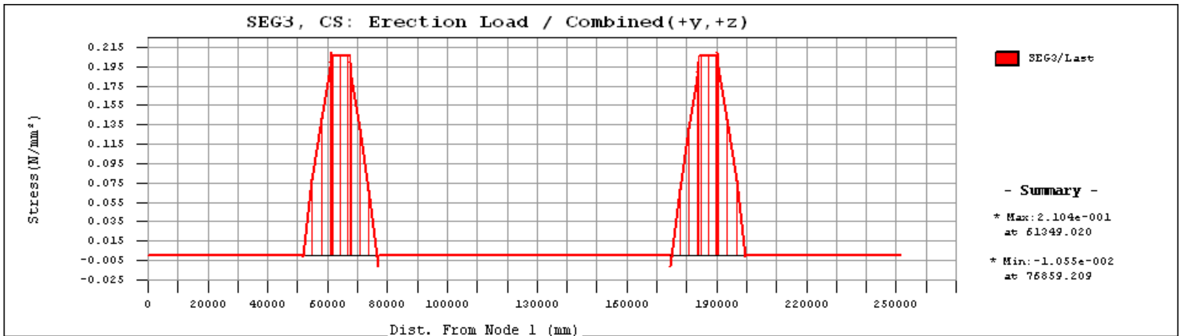

SEG2, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-6.383e-001
at 57846.222

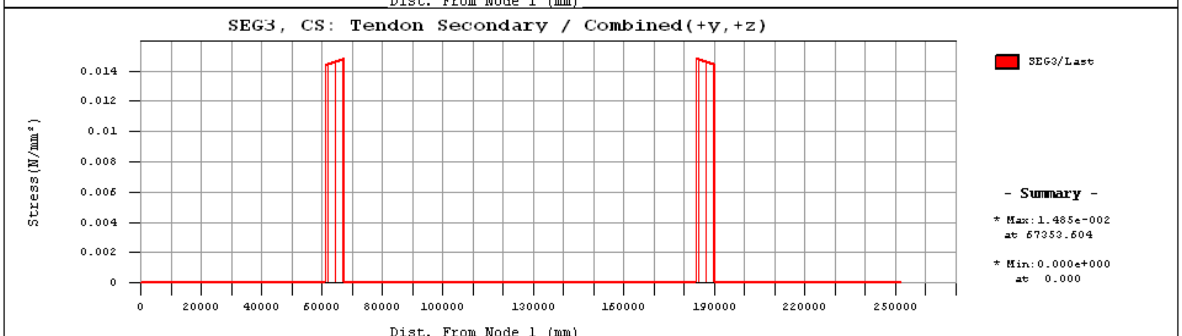

SEG2, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.030e+000
at 180603.614

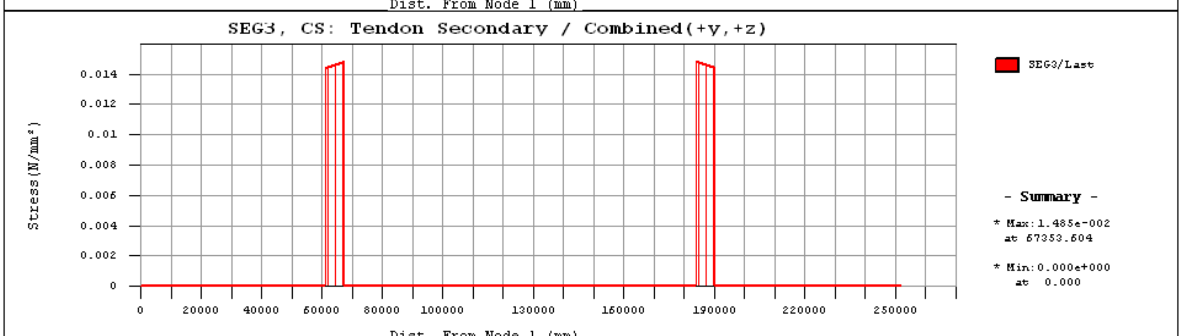
SEGMENT-3

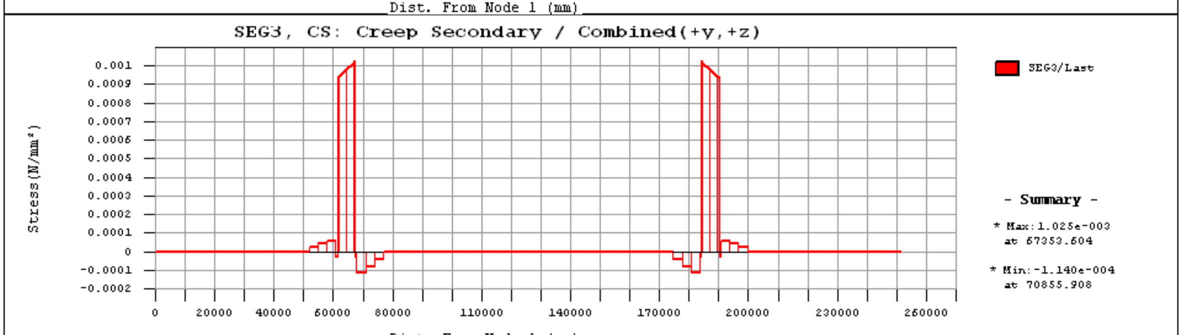

SEG3, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:7.854e-001
at 67353.604
* Min:0.000e+000
at 0.000

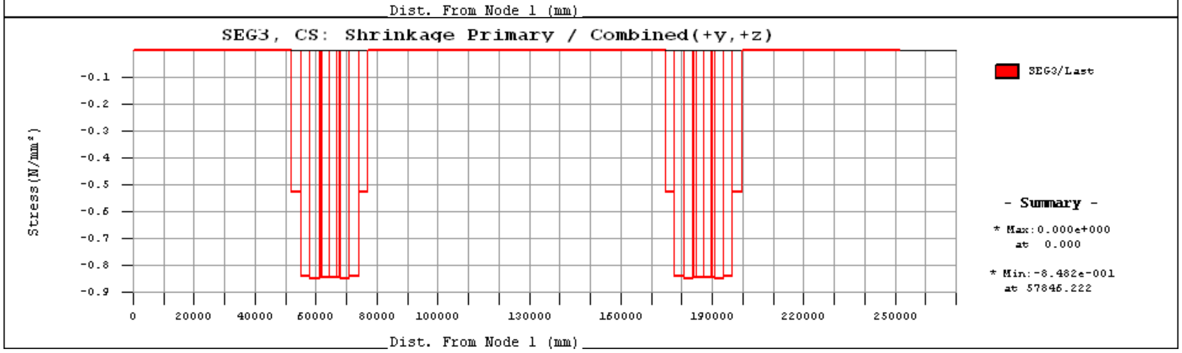

SEG3, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:2.104e-001
at 61349.020
* Min:-1.055e-002
at 76859.209

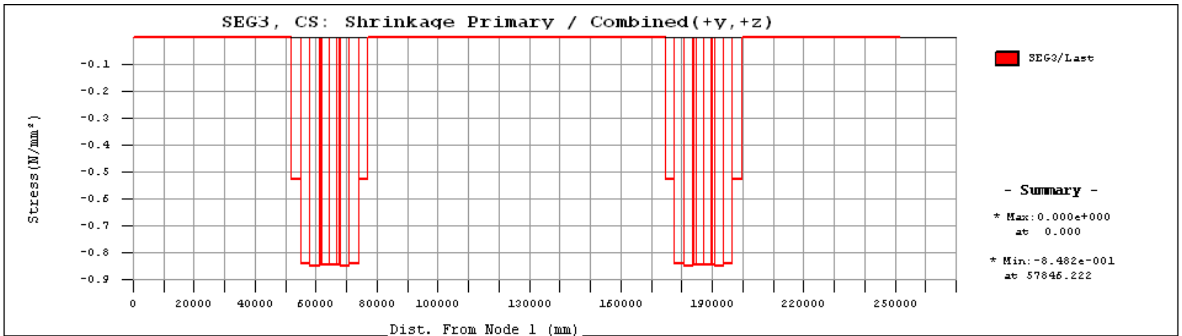

SEG3, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:2.104e-001
at 61349.020
* Min:-1.055e-002
at 76859.209

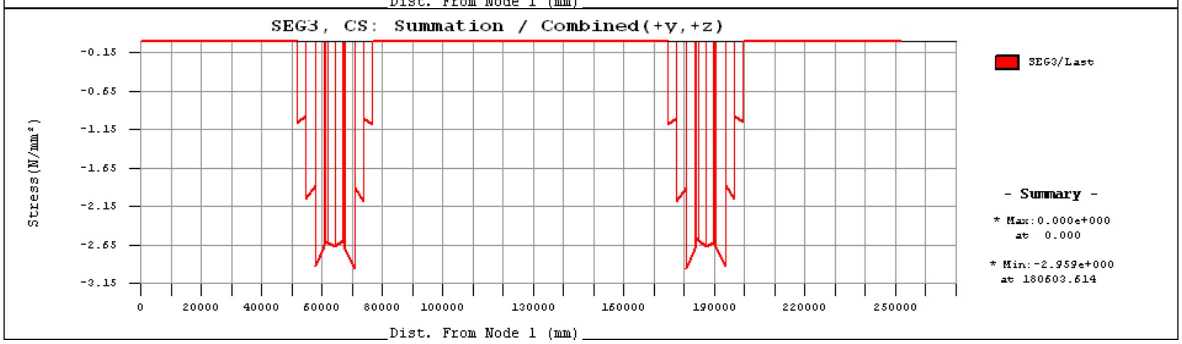

SEG3, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:1.485e-002
at 67353.604
* Min:0.000e+000
at 0.000


SEG3, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:1.485e-002
at 67353.604
* Min:0.000e+000
at 0.000

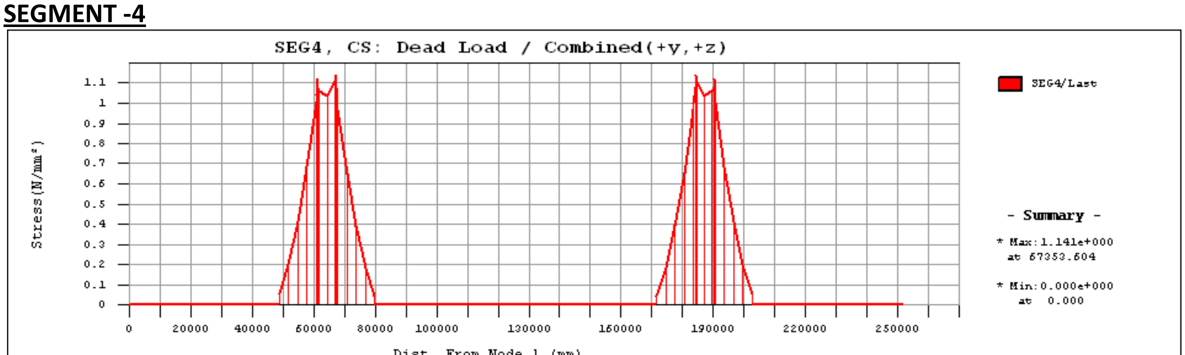

SEG3, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:1.025e-003
at 67353.604
* Min:-1.140e-004
at 70855.908

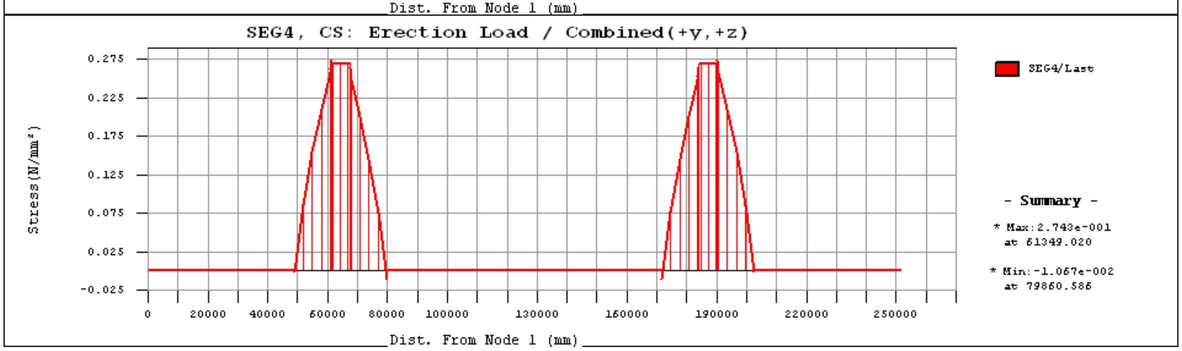

SEG3, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-8.482e-001
at 57846.222

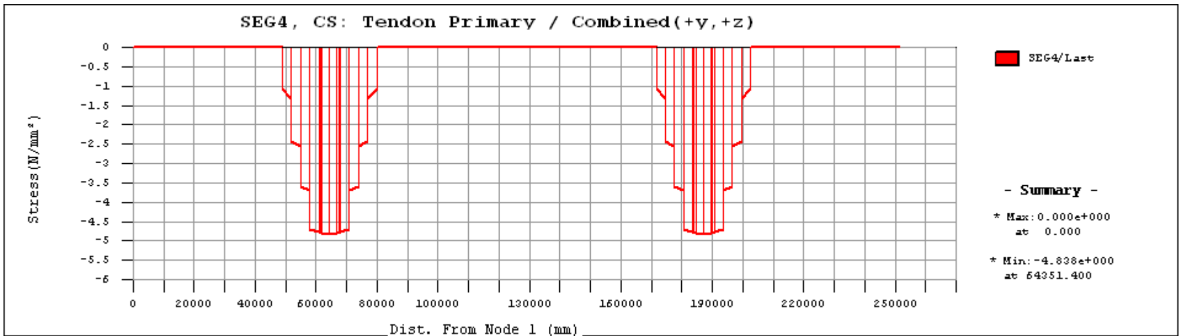

SEG3, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -8.482e-001
at 57846.222

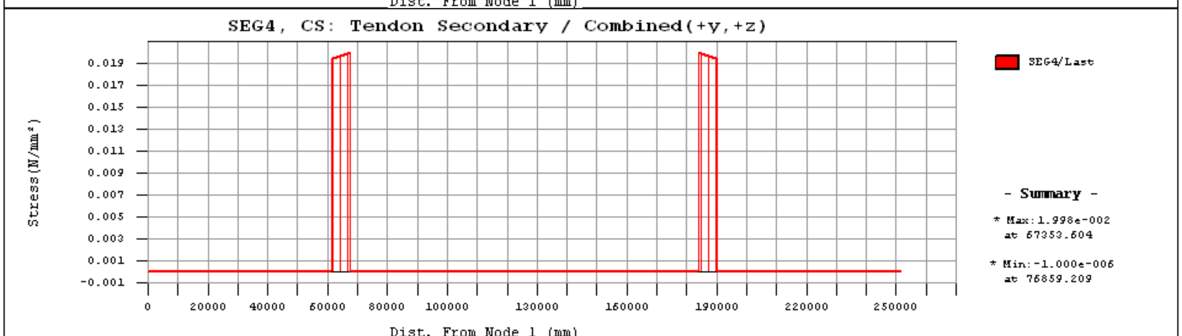

SEG3, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -2.959e+000
at 180603.614

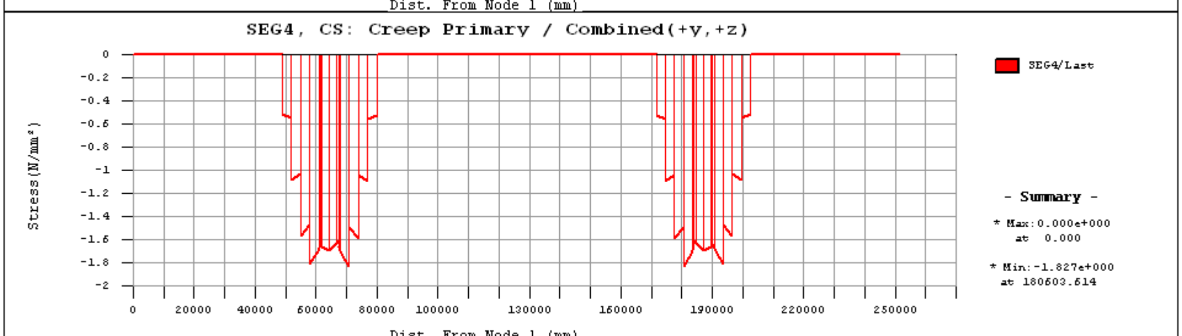
SEGMENT -4

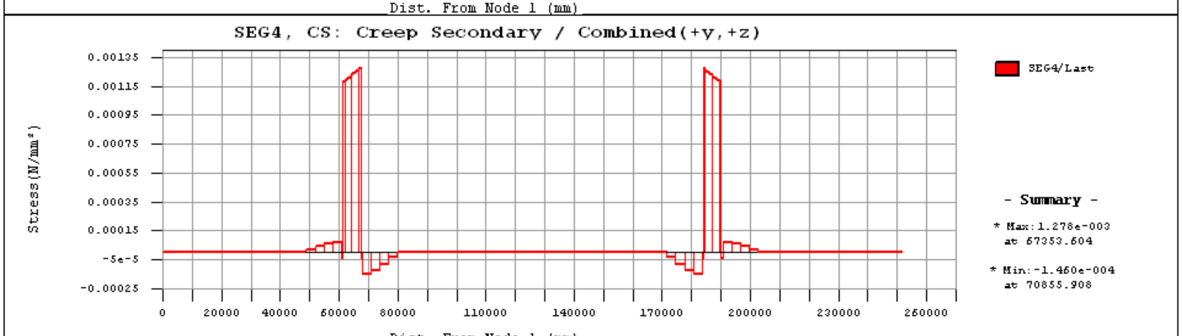

SEG4, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max: 1.141e+000
at 67353.604
* Min: 0.000e+000
at 0.000

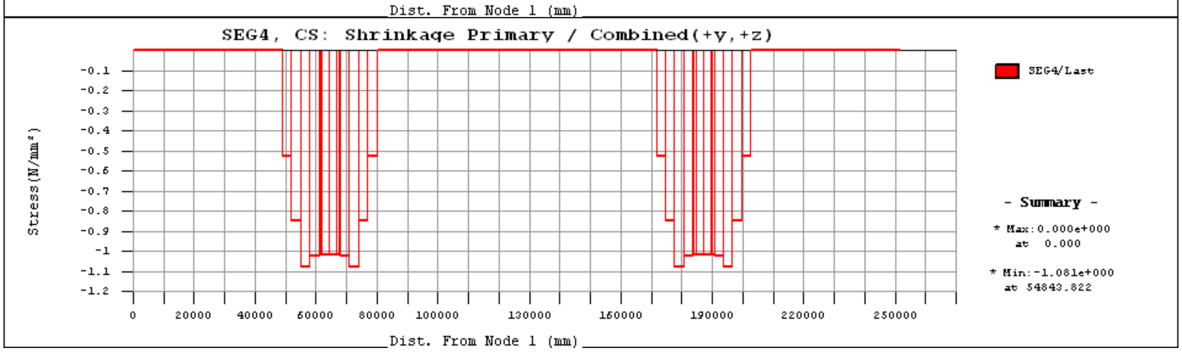

SEG4, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max: 2.743e-001
at 61349.020
* Min: -1.067e-002
at 79860.585

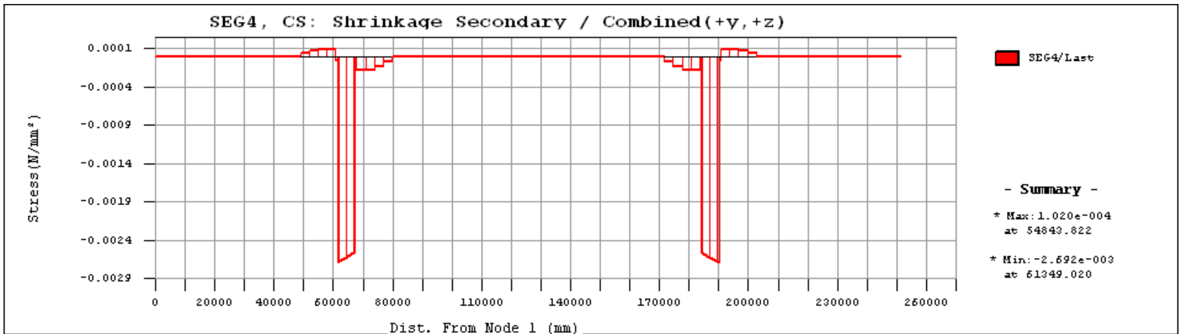

SEG4, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -4.838e+000
at 64351.400

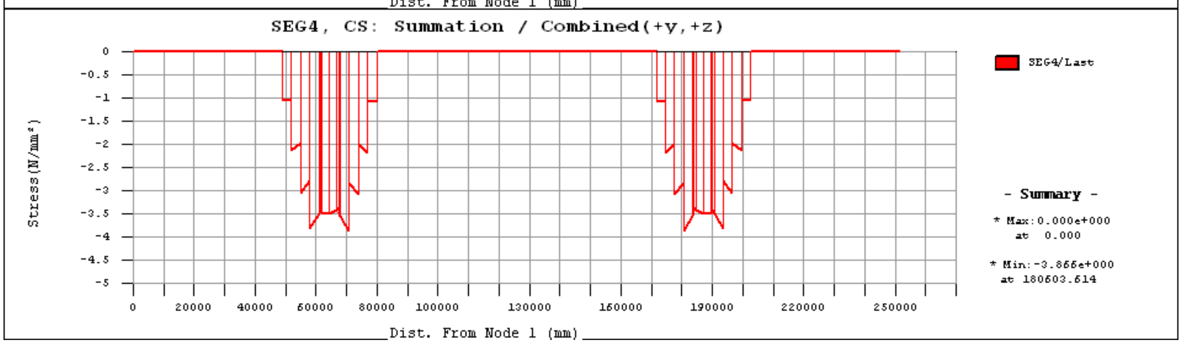

SEG4, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max: 1.998e-002
at 67353.604
* Min: -1.000e-006
at 76859.209


SEG4, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -1.827e+000
at 180603.614

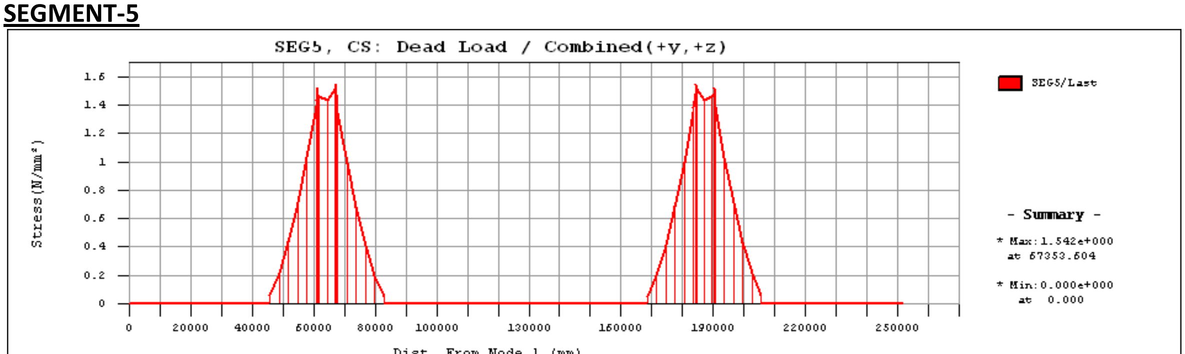

SEG4, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max: 1.278e-003
at 67353.604
* Min: -1.460e-004
at 70855.908

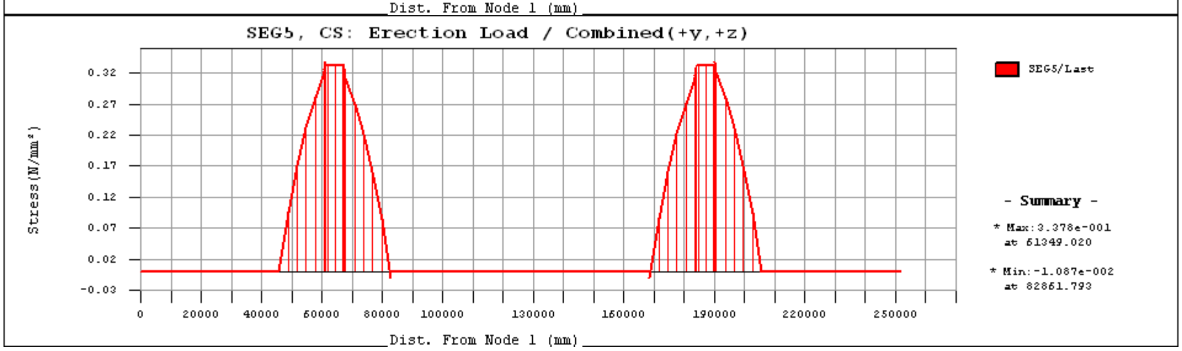

SEG4, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -1.081e+000
at 54843.822

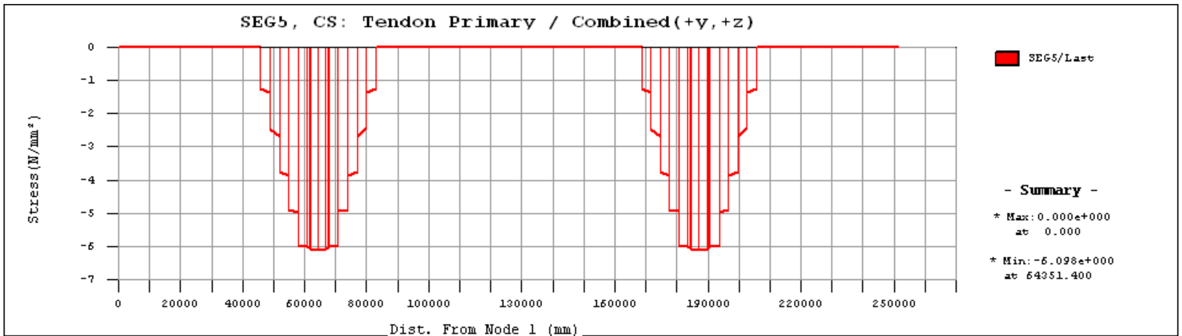

SEG4, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max: 1.020e-004 at 54843.822
* Min: -2.692e-003 at 61349.020

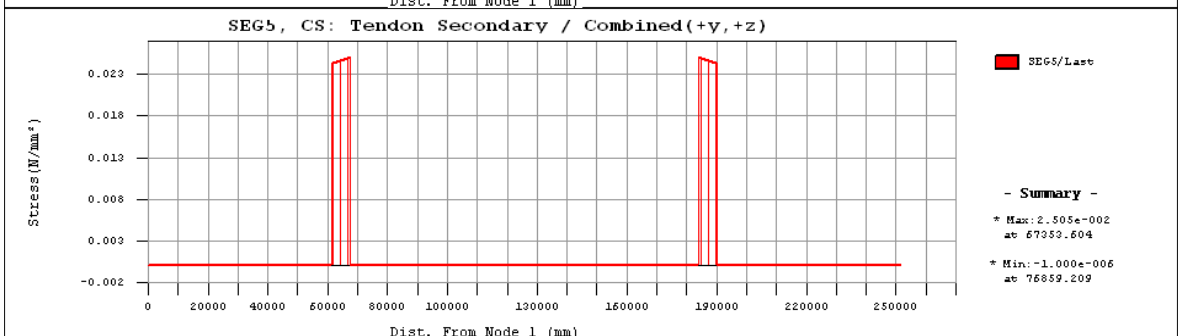

SEG4, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -3.866e+000 at 180603.614

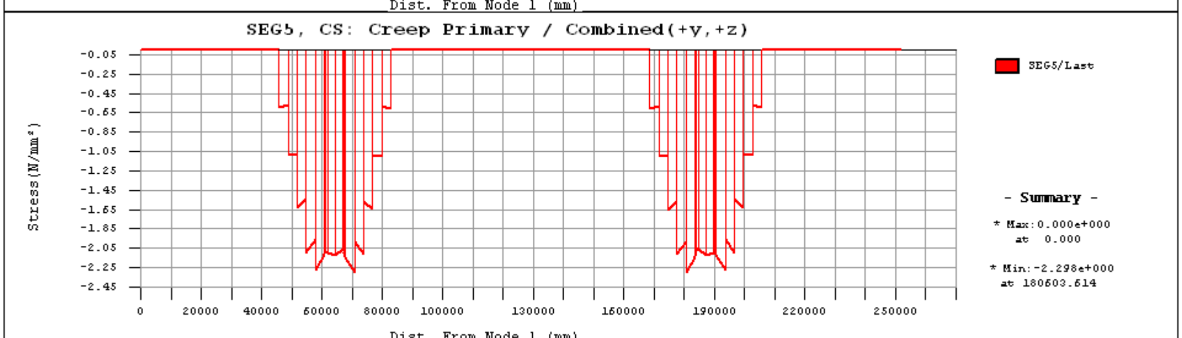
SEGMENT-5

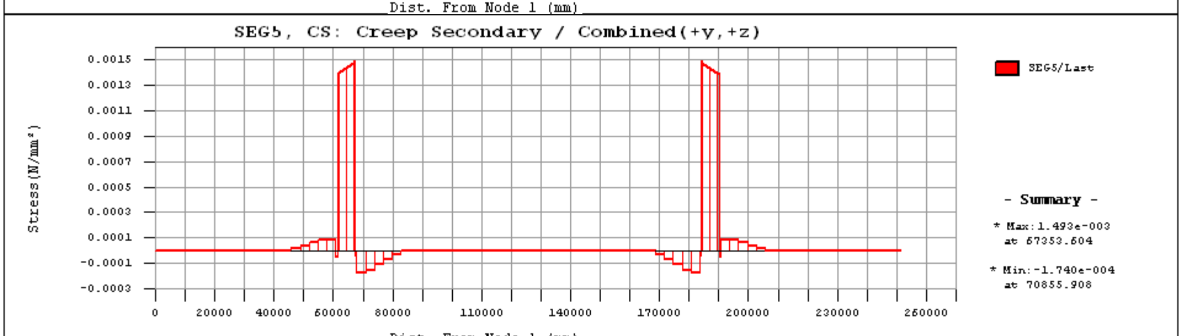

SEG5, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max: 1.542e+000 at 67353.604
* Min: 0.000e+000 at 0.000

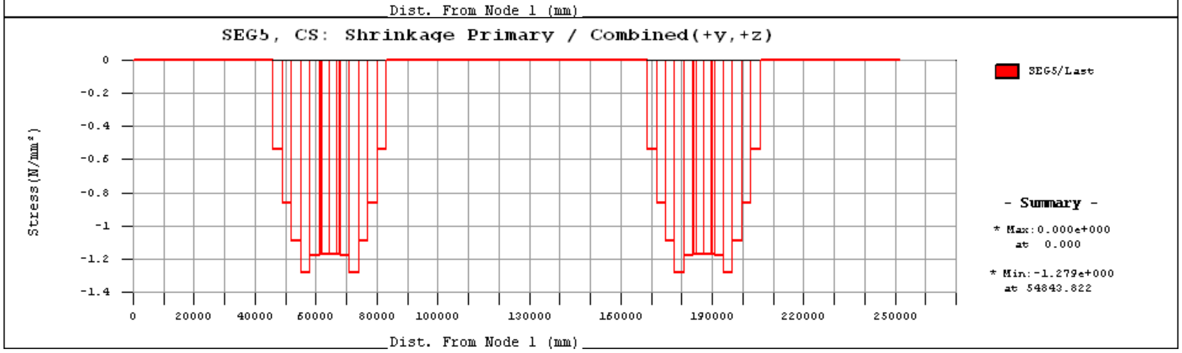

SEG5, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max: 3.378e-001 at 61349.020
* Min: -1.087e-002 at 82851.793

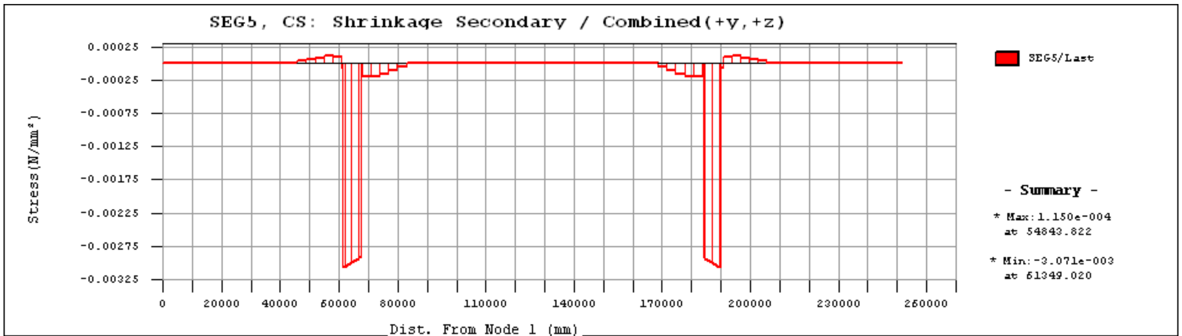

SEG5, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-6.098e+000
at 64351.400

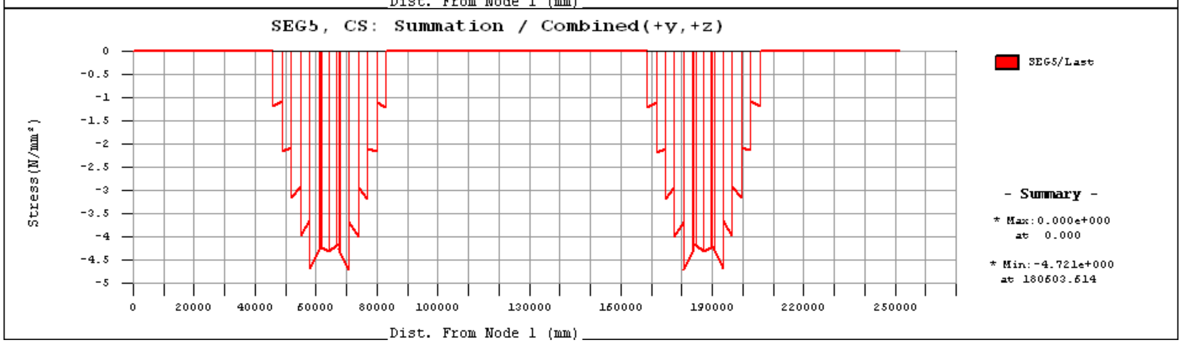

SEG5, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:2.505e-002
at 67353.604
* Min:-1.000e-006
at 76859.209


SEG5, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.298e+000
at 180603.614

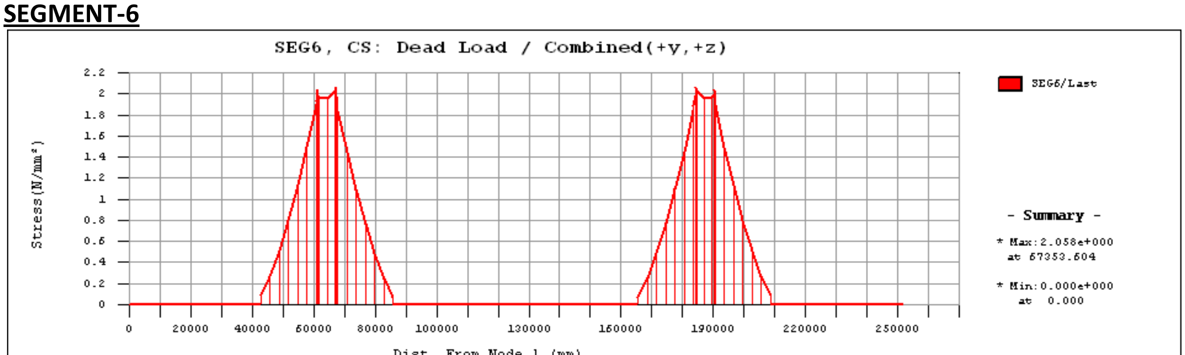

SEG5, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:1.493e-003
at 67353.604
* Min:-1.740e-004
at 70855.908

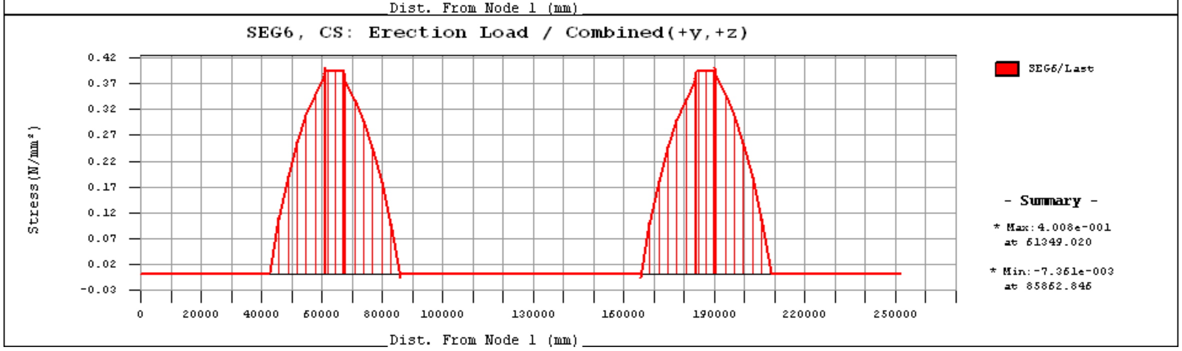

SEG5, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.279e+000
at 54843.822

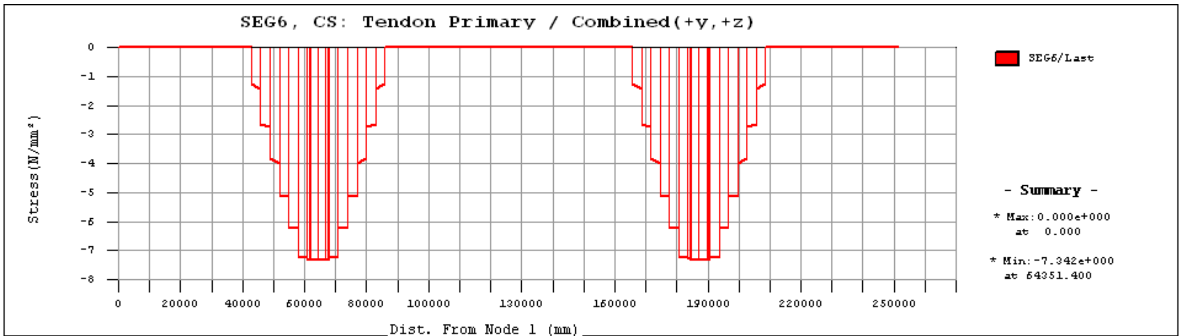

SEG5, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max: 1.150e-004 at 54843.822
* Min: -3.071e-003 at 61349.020

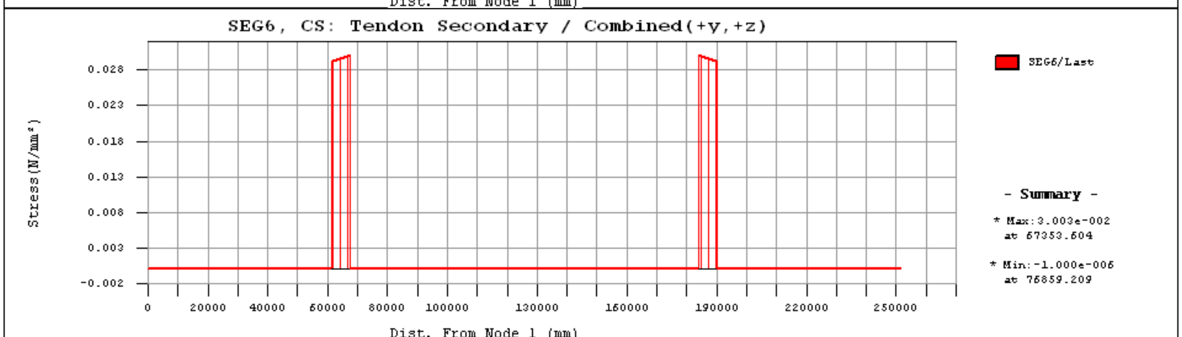

SEG5, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -4.721e+000 at 180503.614

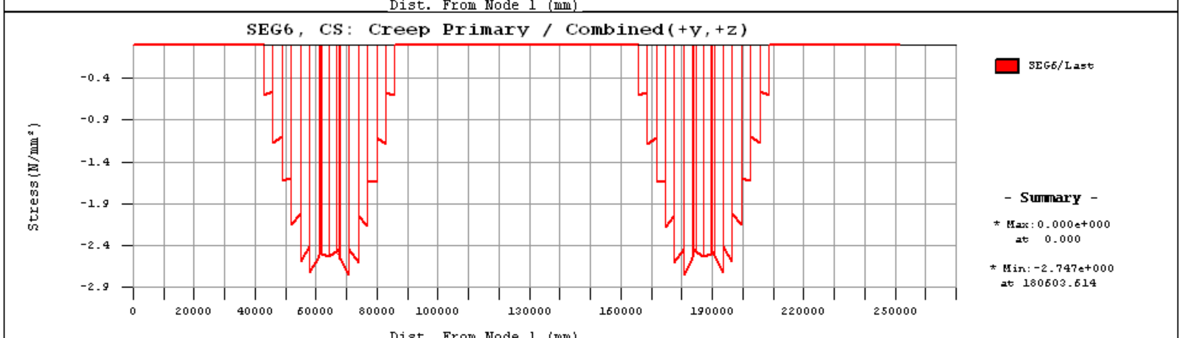
SEGMENT-6

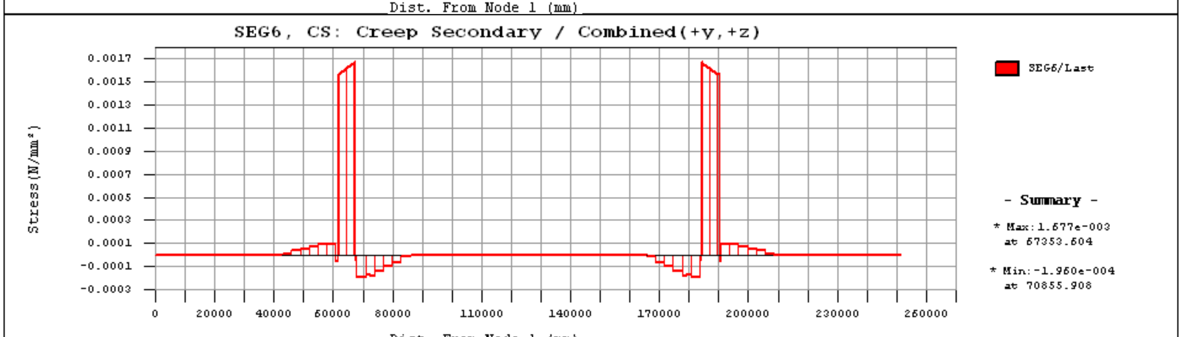

SEG6, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max: 2.058e+000 at 67353.604
* Min: 0.000e+000 at 0.000

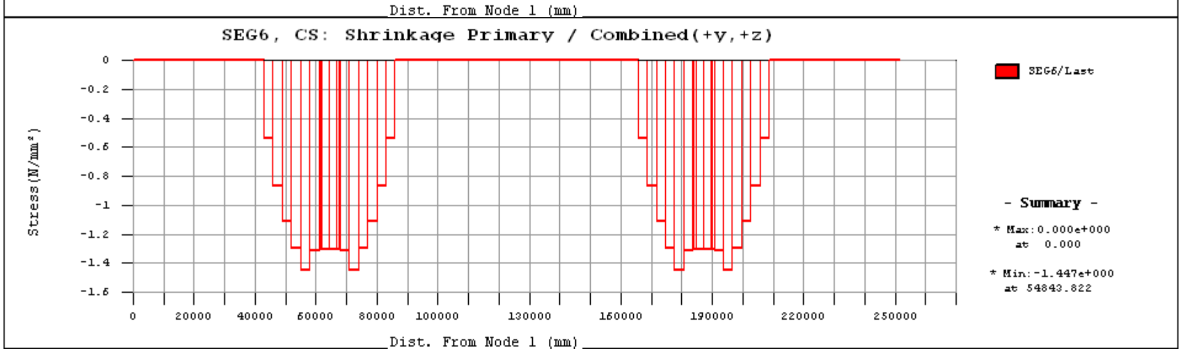

SEG6, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max: 4.008e-001 at 61349.020
* Min: -7.361e-003 at 85862.846

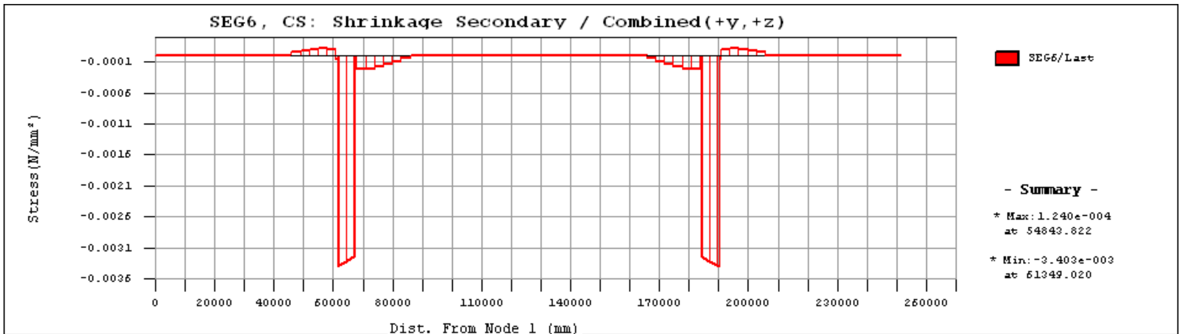

SEG6, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -7.342e+000
at 64351.400

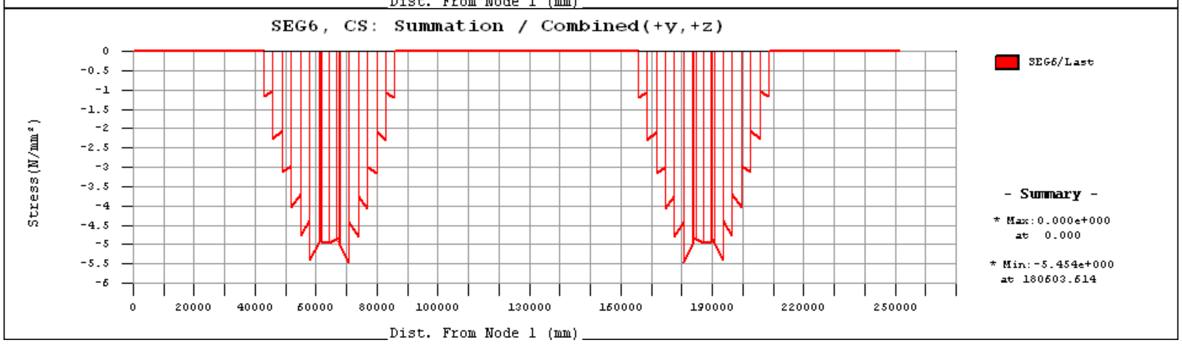

SEG6, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max: 3.003e-002
at 67353.604
* Min: -1.000e-006
at 76859.209


SEG6, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -2.747e+000
at 180603.614

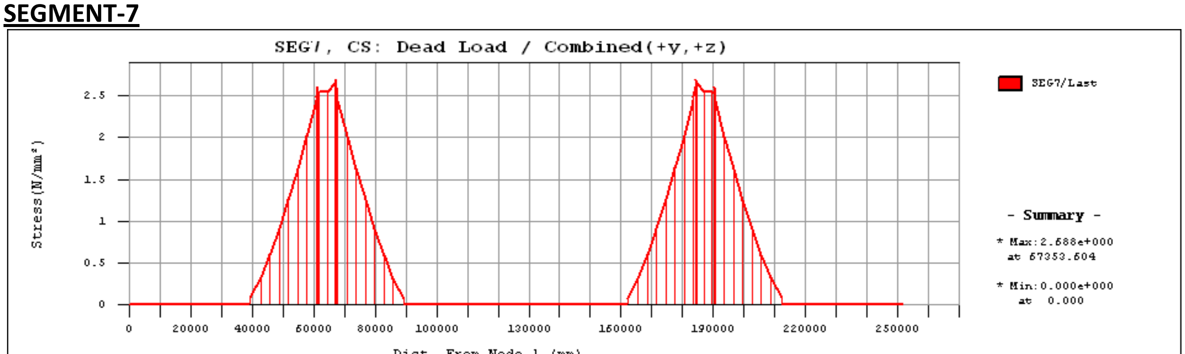

SEG6, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max: 1.677e-003
at 67353.604
* Min: -1.960e-004
at 70855.908

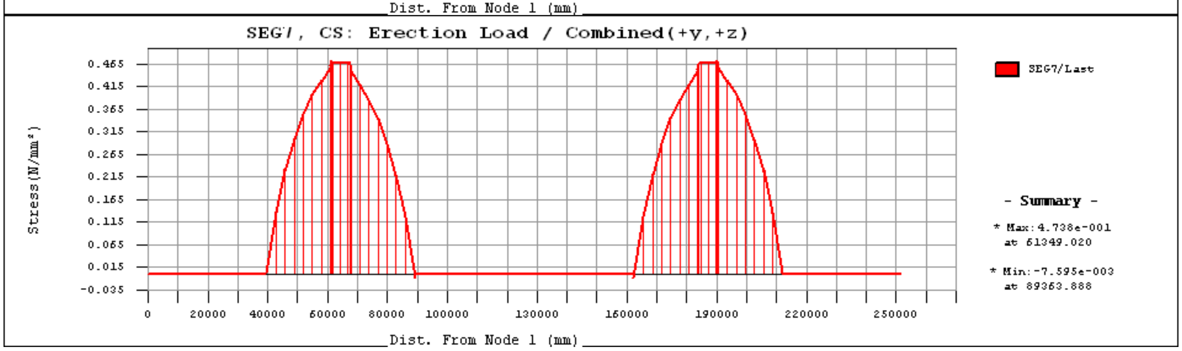

SEG6, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -1.447e+000
at 54843.822

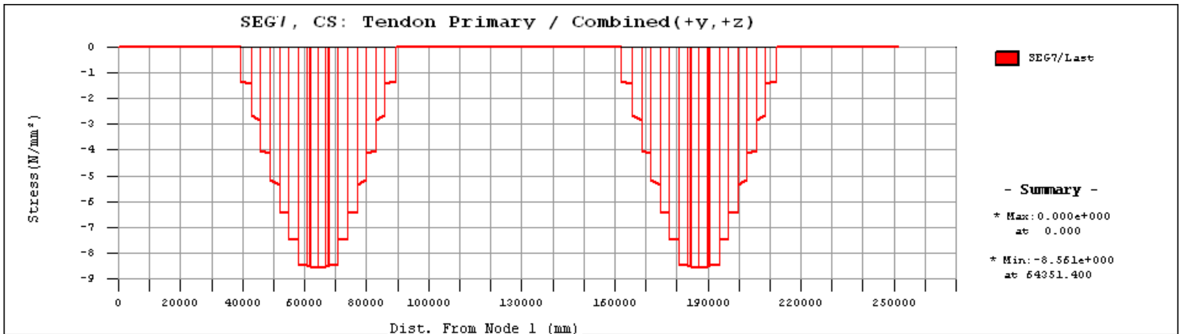

SEG6, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max: 1.240e-004 at 54843.822
* Min: -3.403e-003 at 61349.020

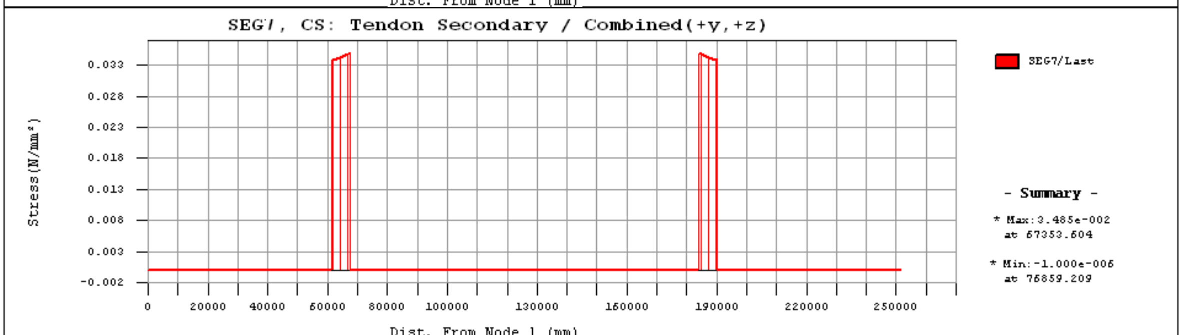

SEG6, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -5.454e+000 at 180603.614

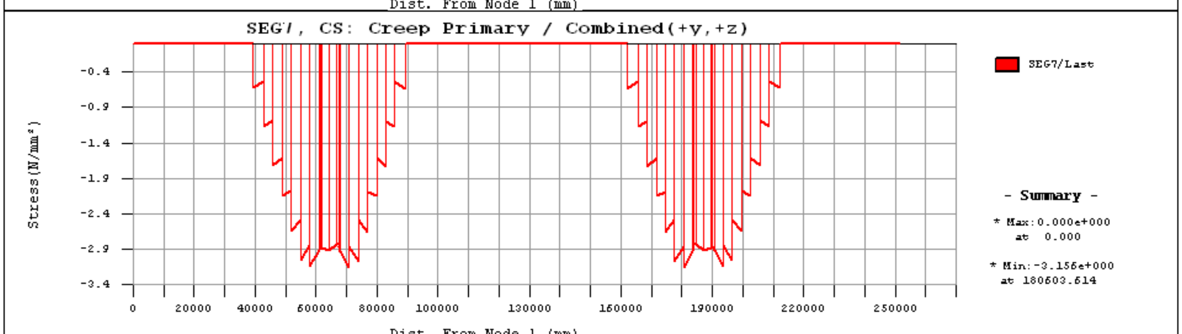
SEGMENT-7

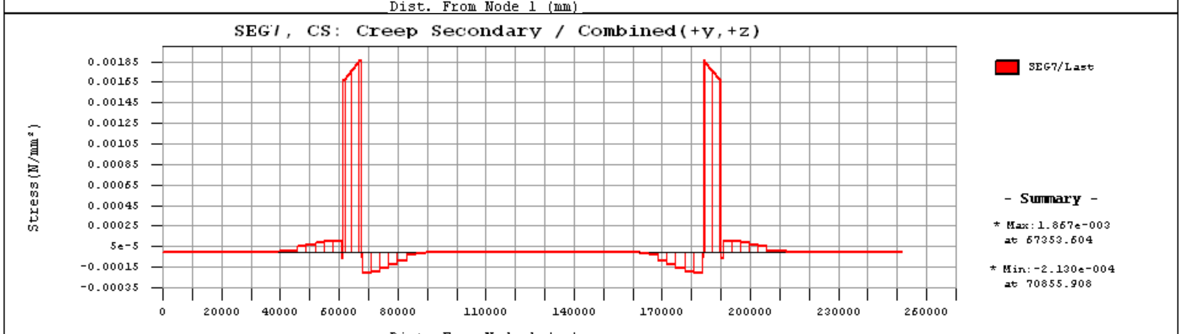

SEG7, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max: 2.688e+000 at 67353.604
* Min: 0.000e+000 at 0.000

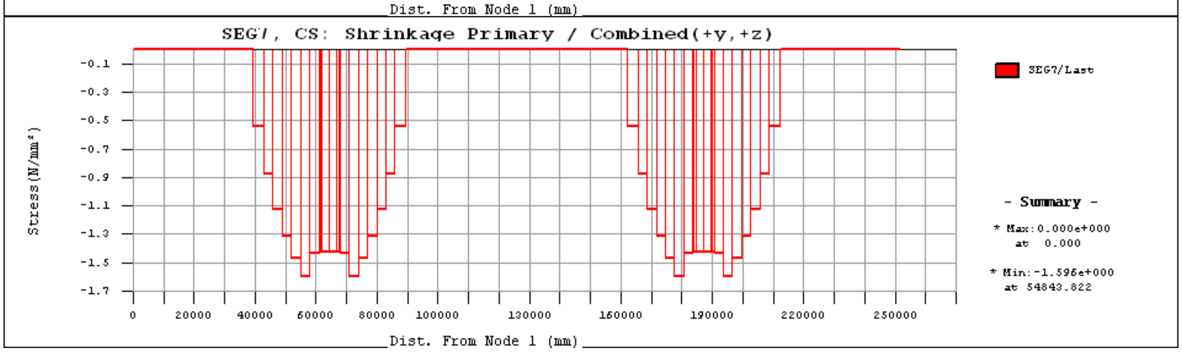

SEG7, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max: 4.738e-001 at 61349.020
* Min: -7.595e-003 at 89353.888

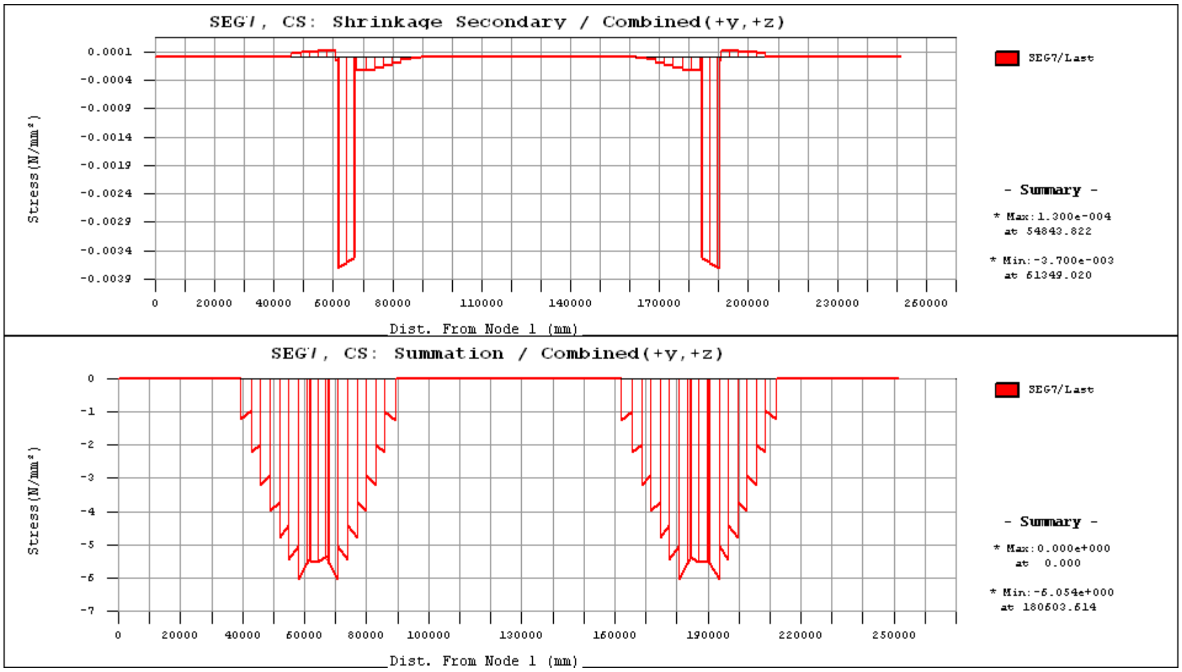

SEG7, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-8.561e+000
at 64351.400


SEG7, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:3.485e-002
at 67353.604
* Min:-1.000e-006
at 76859.209

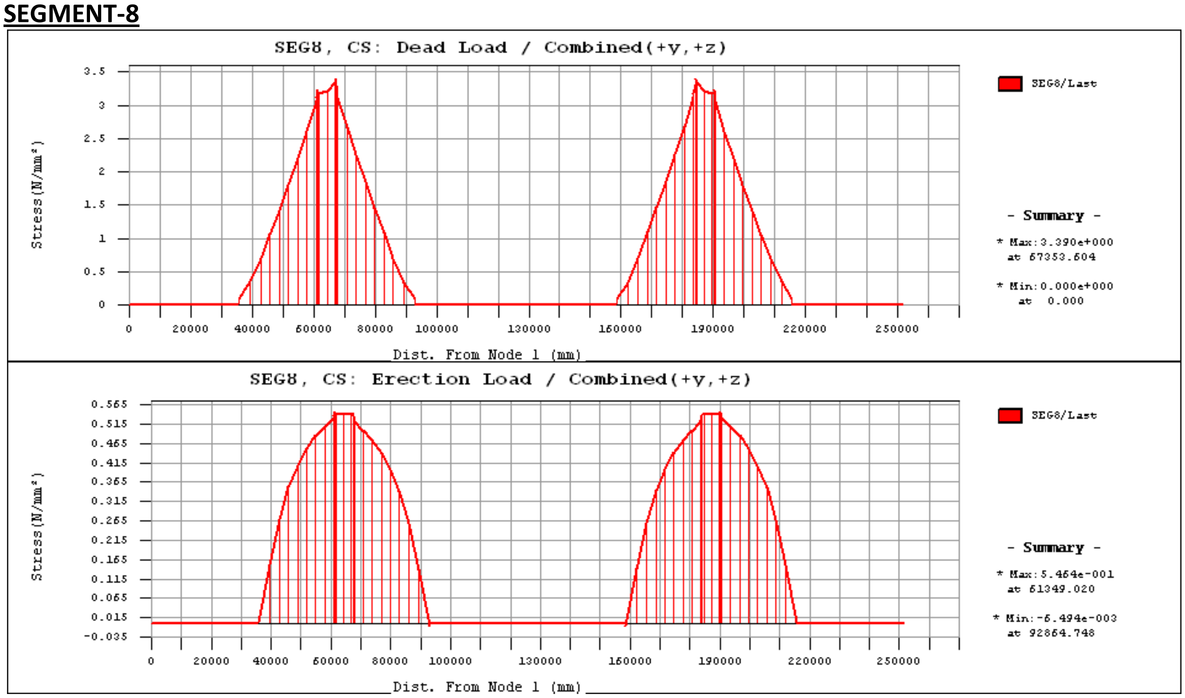

SEG7, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-3.156e+000
at 180503.614

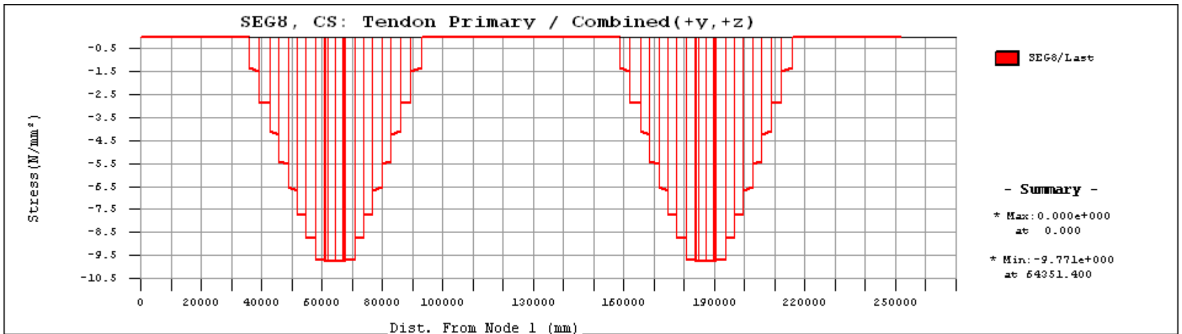

SEG7, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:1.867e-003
at 67353.604
* Min:-2.130e-004
at 70855.908

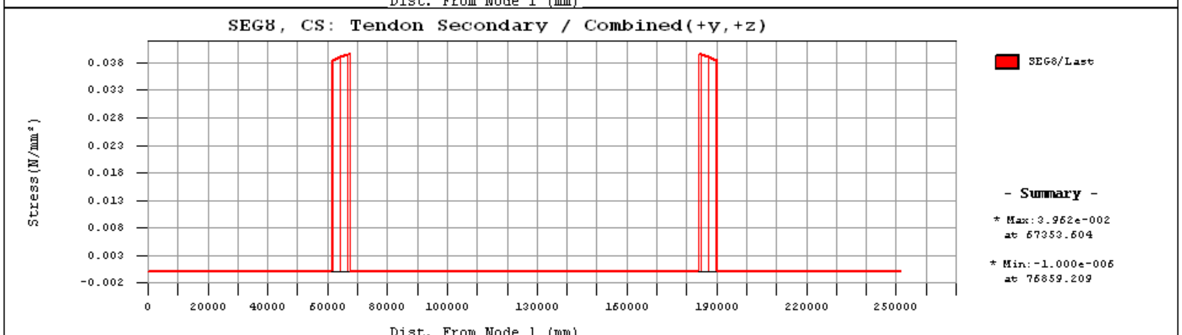

SEG7, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.596e+000
at 54843.822

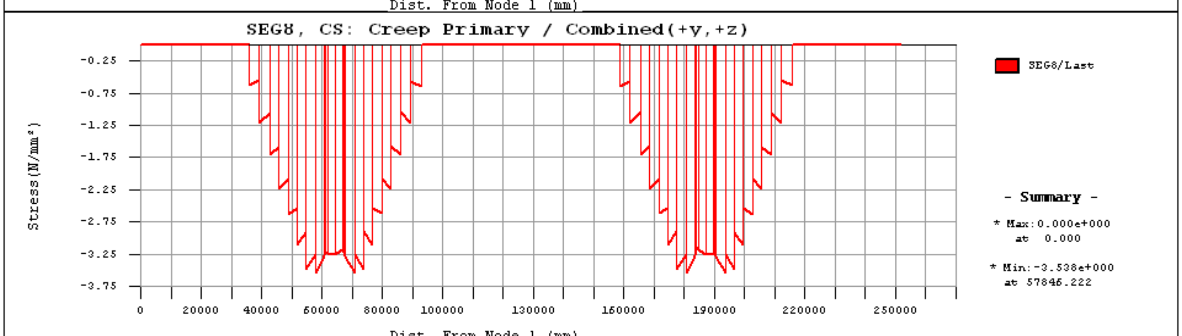

SEG7, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max: 1.300e-004 at 54843.822
* Min: -3.700e-003 at 61349.020
SEG7, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -6.054e+000 at 180603.614

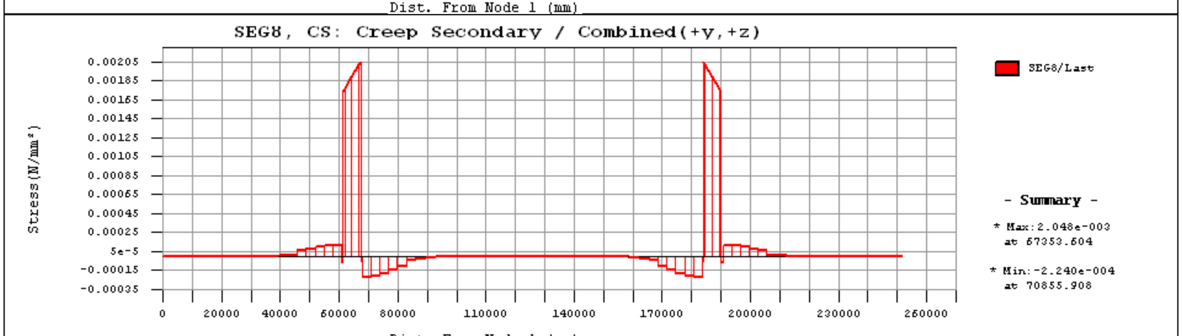
SEGMENT-8

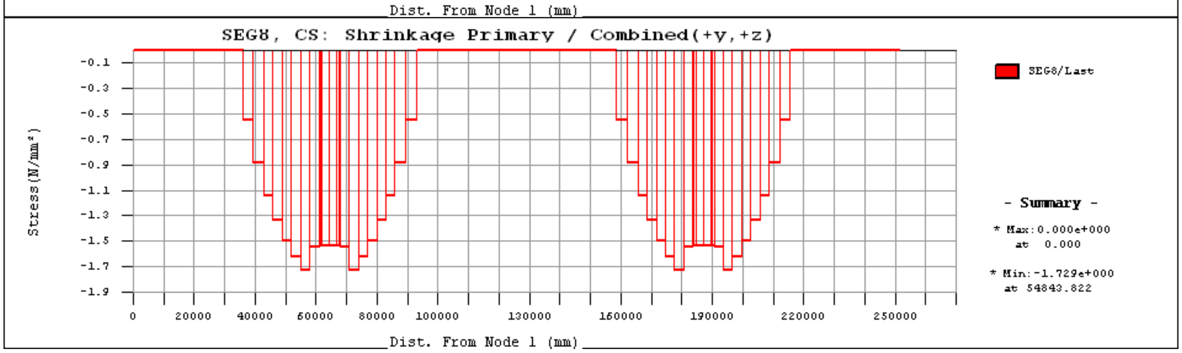

SEG8, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max: 3.390e+000 at 67353.604
* Min: 0.000e+000 at 0.000
SEG8, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max: 5.464e-001 at 61349.020
* Min: -6.494e-003 at 92864.748

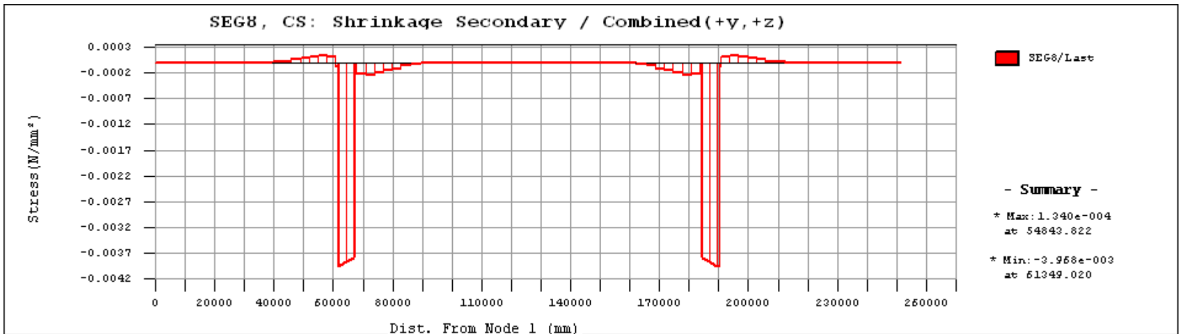

SEG8, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-9.771e+000
at 64351.400

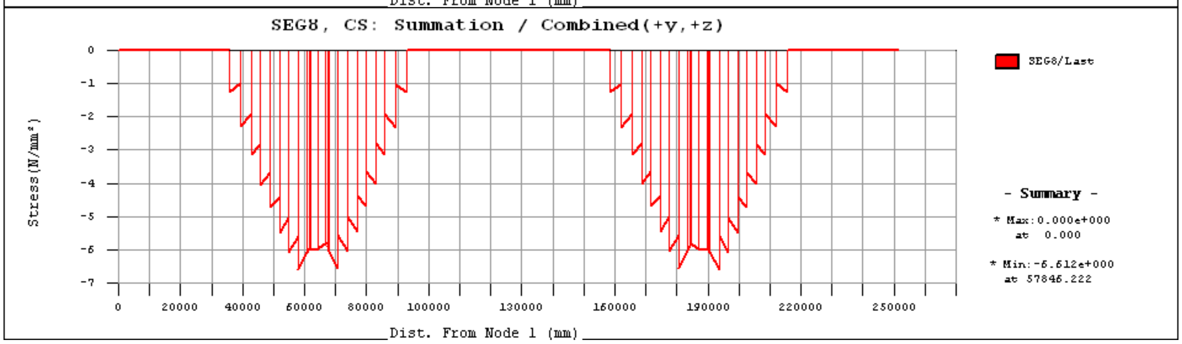

SEG8, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:3.962e-002
at 67353.604
* Min:-1.000e-005
at 75859.209


SEG8, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-3.538e+000
at 57846.222

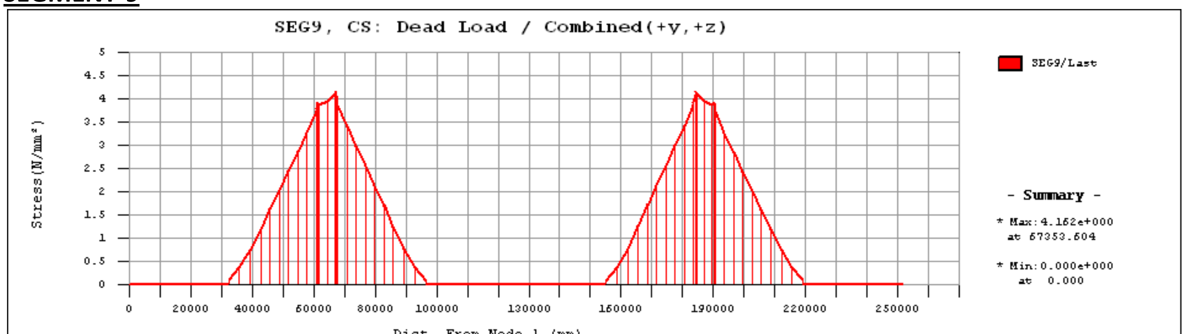

SEG8, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:2.048e-003
at 67353.604
* Min:-2.240e-004
at 70855.908

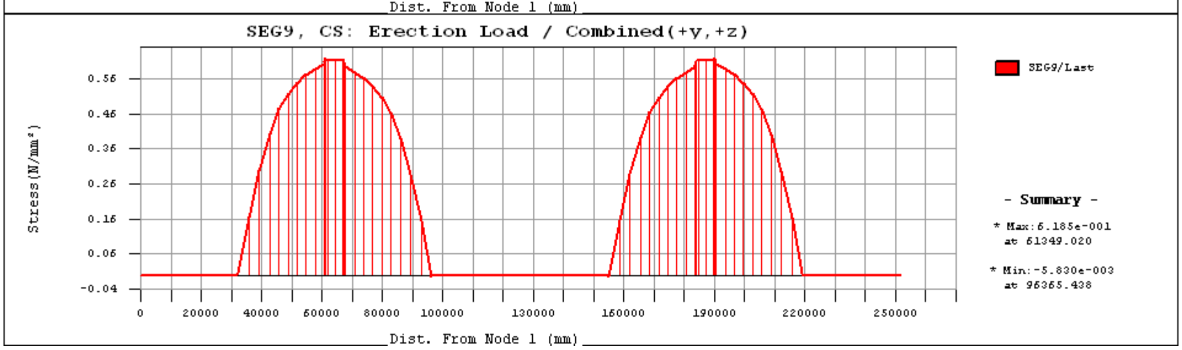

SEG8, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.729e+000
at 54843.822

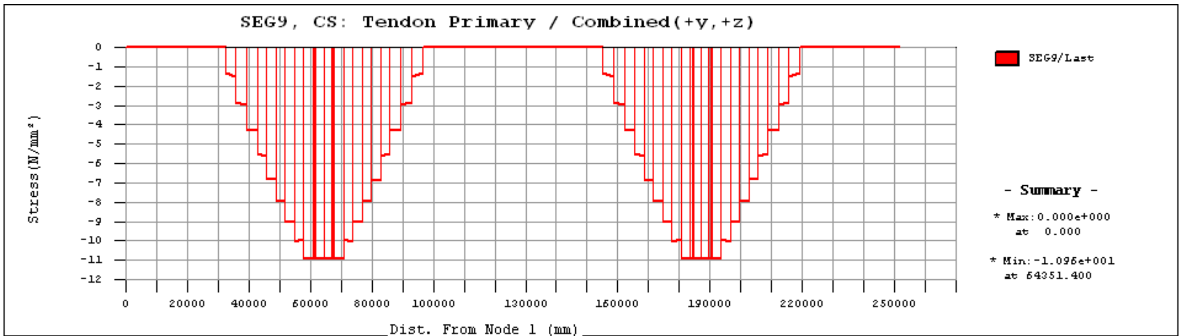

SEG8, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:1.340e-004
at 54843.822
* Min:-3.958e-003
at 61349.020

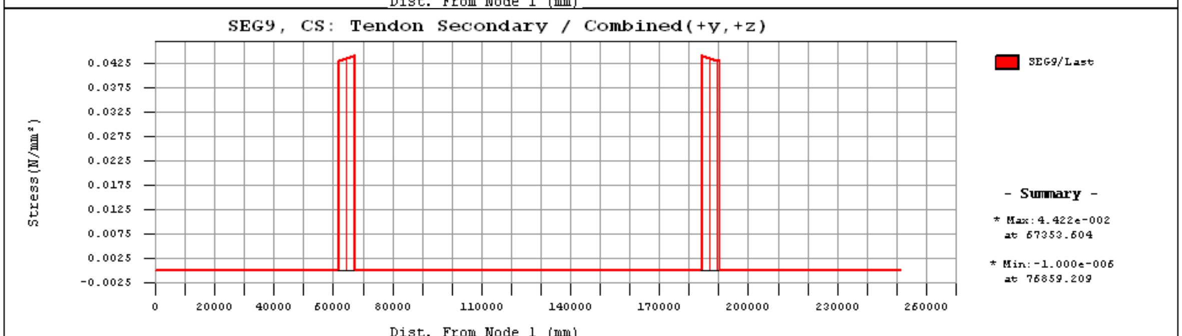

SEG8, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-6.612e+000
at 57846.222

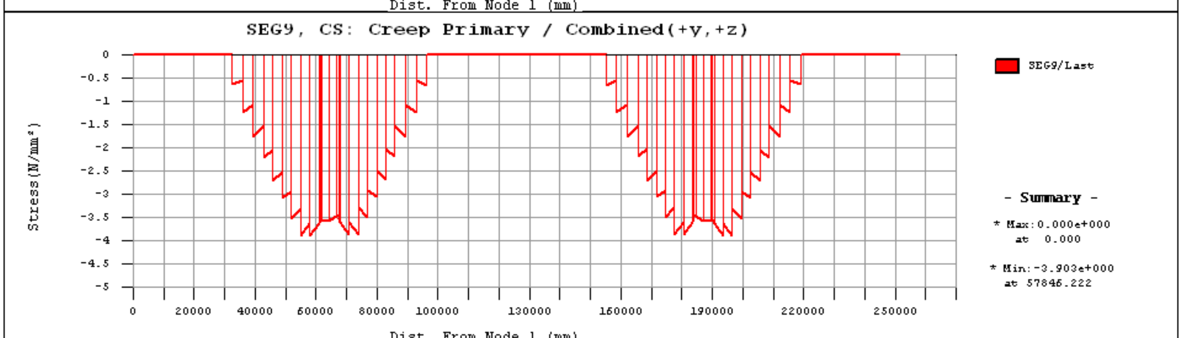
SEGMENT-9

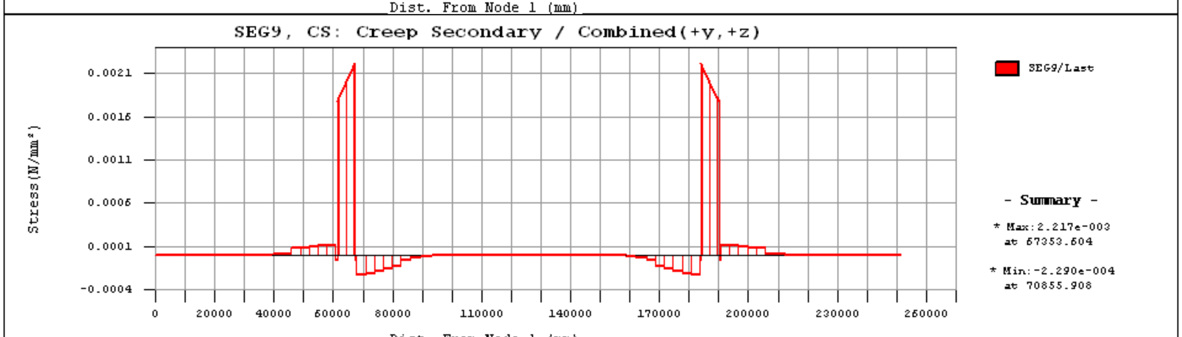

SEG9, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:4.162e+000
at 67353.604
* Min:0.000e+000
at 0.000

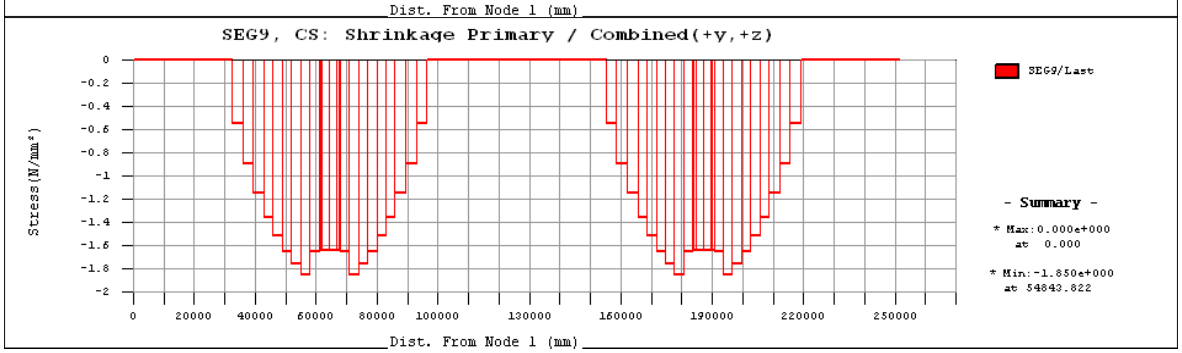

SEG9, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:6.185e-001
at 61349.020
* Min:-5.830e-003
at 95365.438

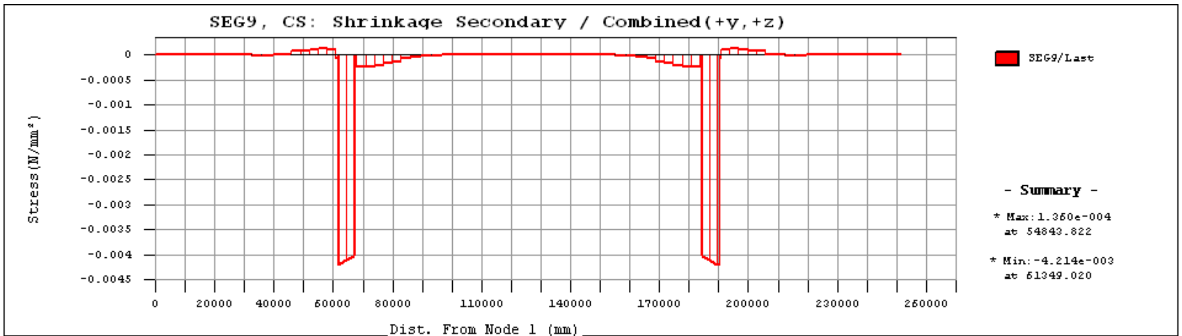

SEG9, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.096e+001
at 64351.400

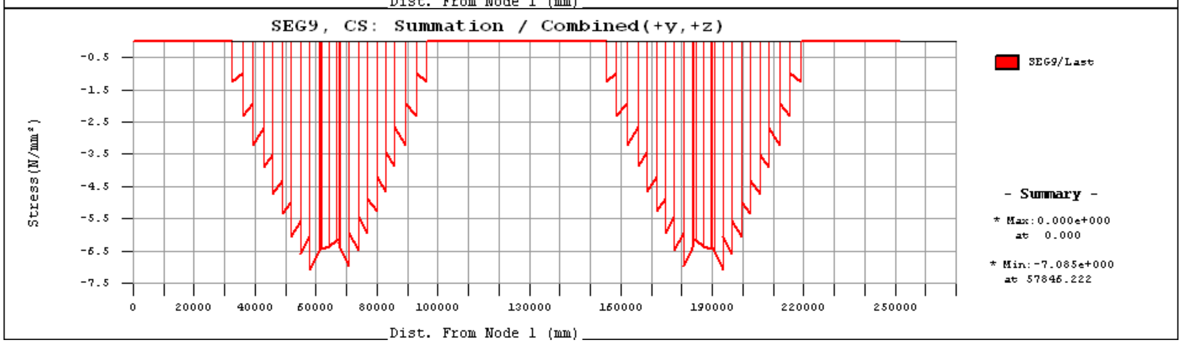

SEG9, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:4.422e-002
at 67353.604
* Min:-1.000e-006
at 76859.209


SEG9, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-3.903e+000
at 57846.222

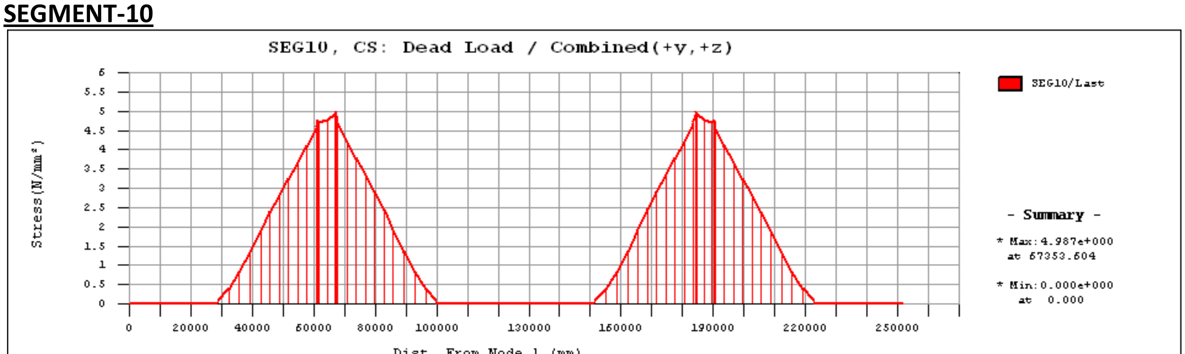

SEG9, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:2.217e-003
at 67353.604
* Min:-2.290e-004
at 70855.908

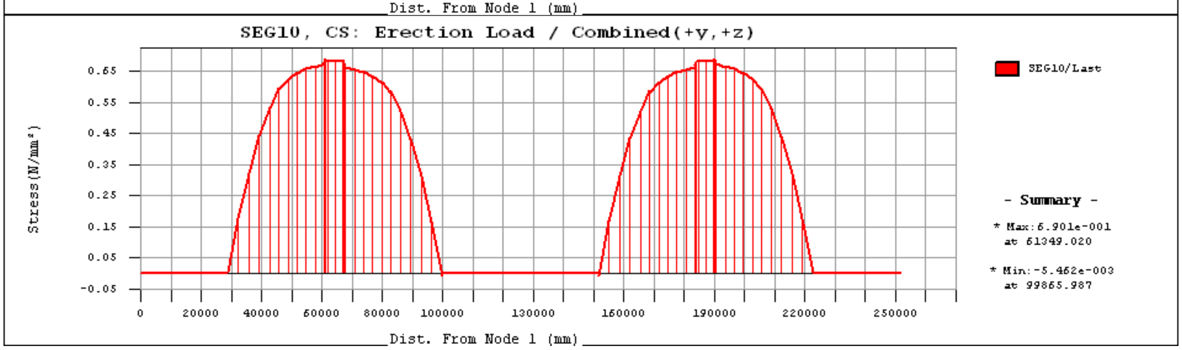

SEG9, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.850e+000
at 54843.822

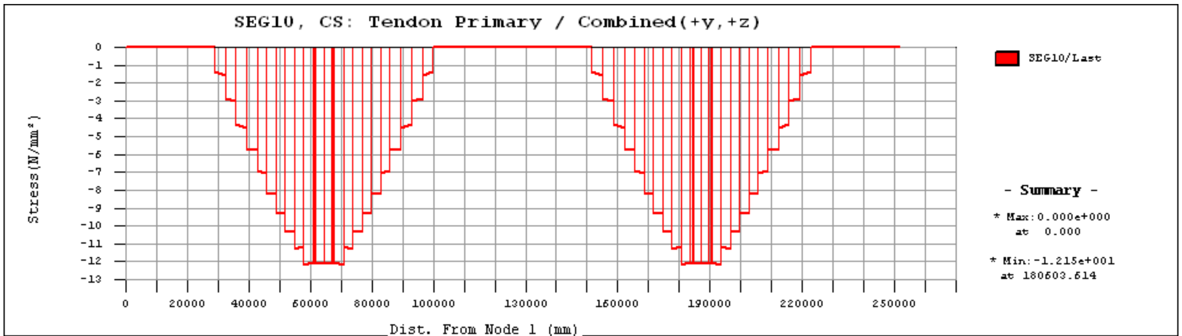

SEG9, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:1.360e-004
at 54843.822
* Min:-4.214e-003
at 61349.020

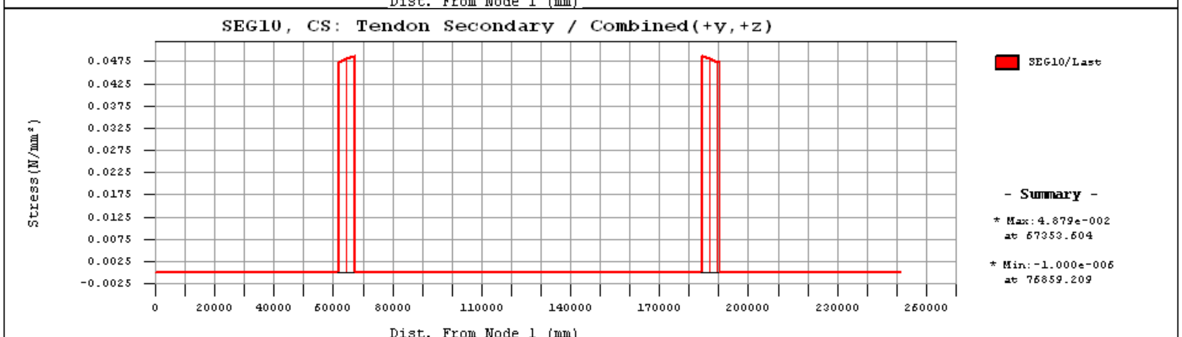

SEG9, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-7.085e+000
at 57846.222

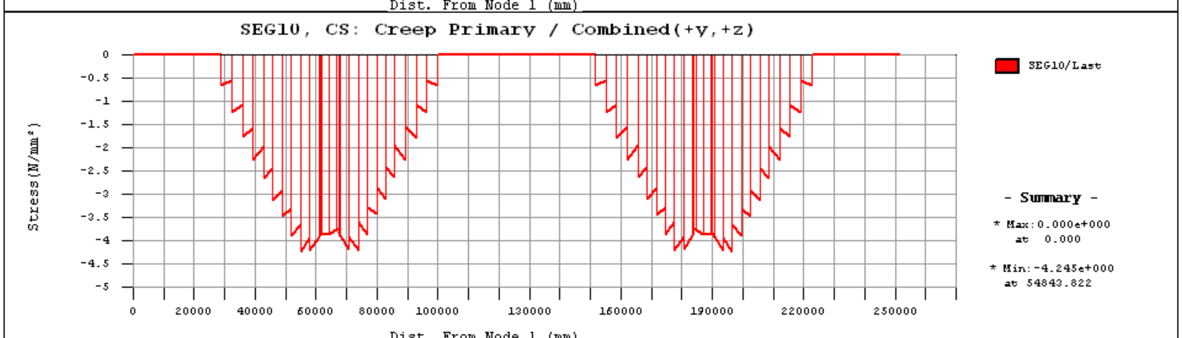
SEGMENT-10

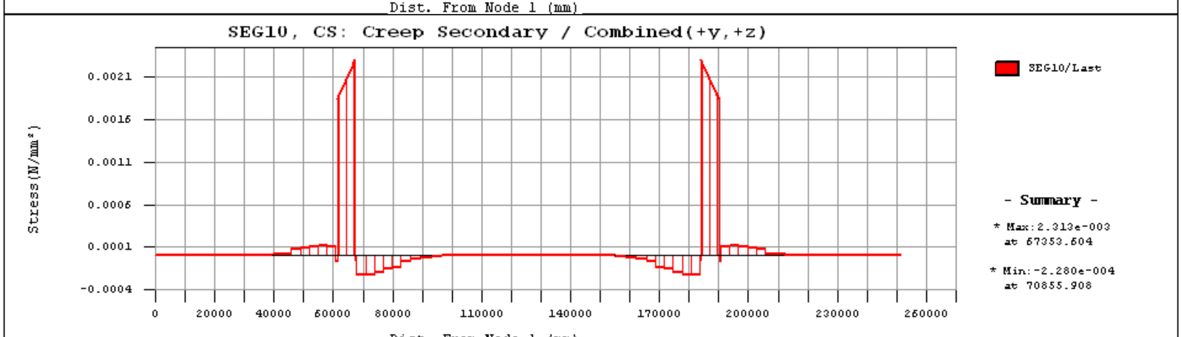

SEG10, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:4.987e+000
at 67353.604
* Min:0.000e+000
at 0.000

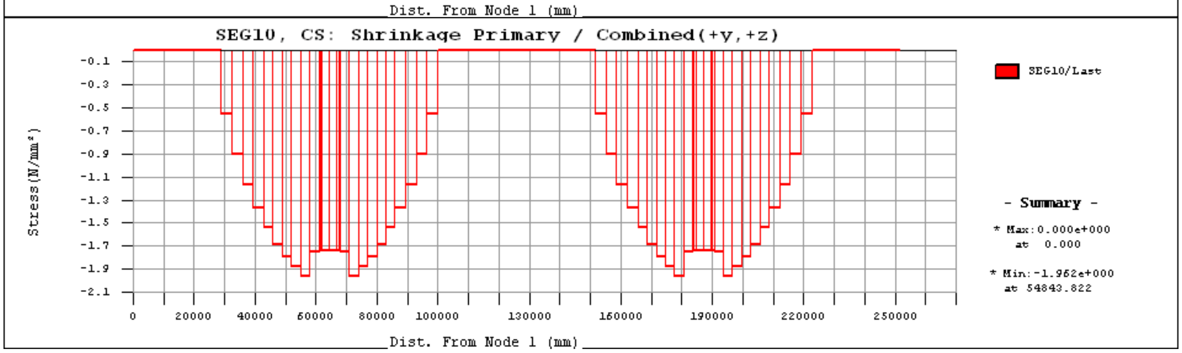

SEG10, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:6.901e-001
at 61349.020
* Min:-5.462e-003
at 99865.987

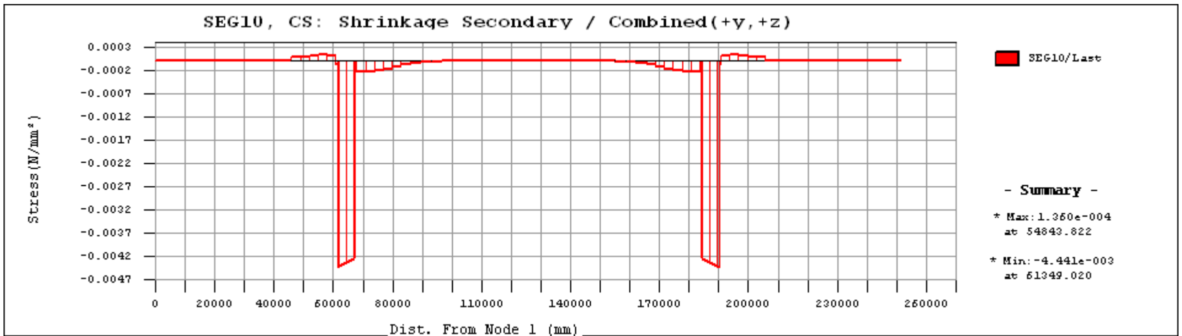

SEG10, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.215e+001
at 180503.614

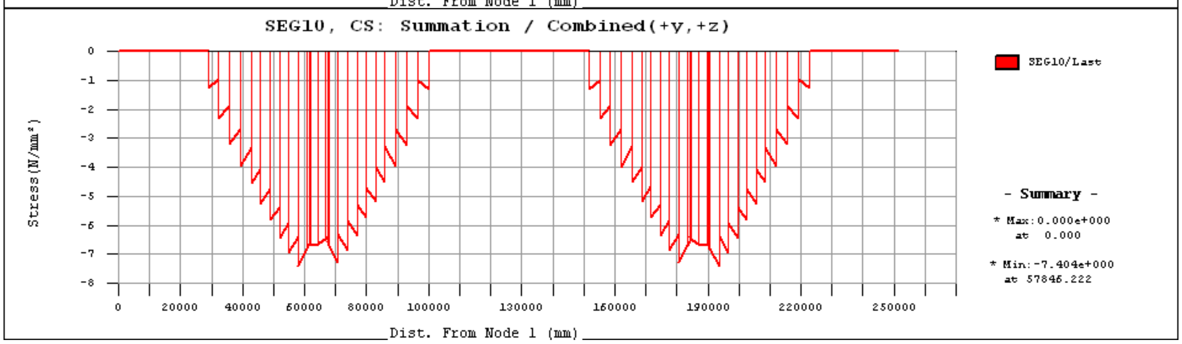

SEG10, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:4.879e-002
at 67353.604
* Min:-1.000e-006
at 76859.209


SEG10, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-4.245e+000
at 54843.822

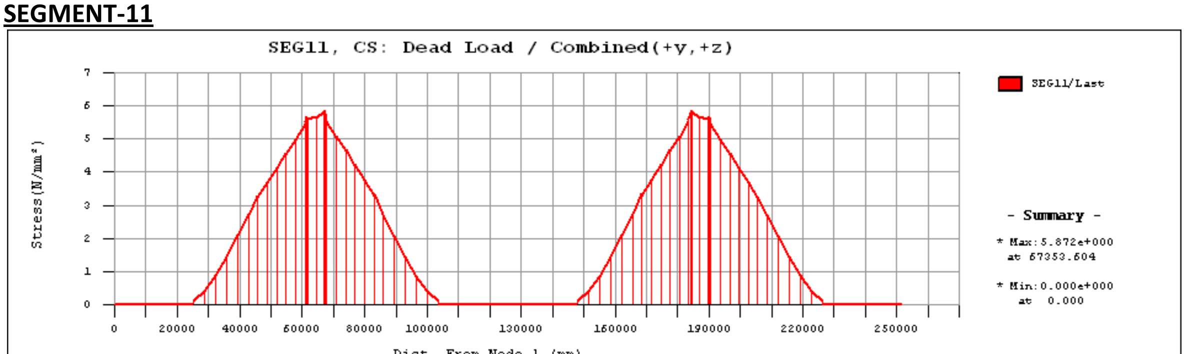

SEG10, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:2.313e-003
at 67353.604
* Min:-2.280e-004
at 70855.908

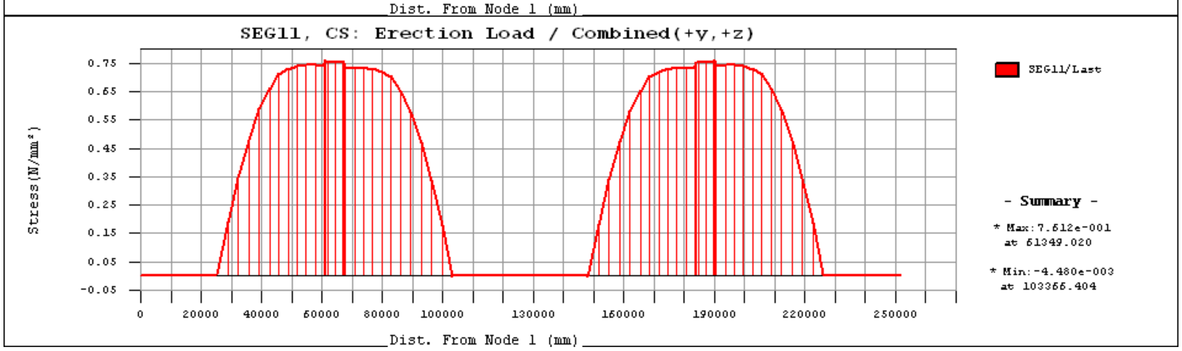

SEG10, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.962e+000
at 54843.822

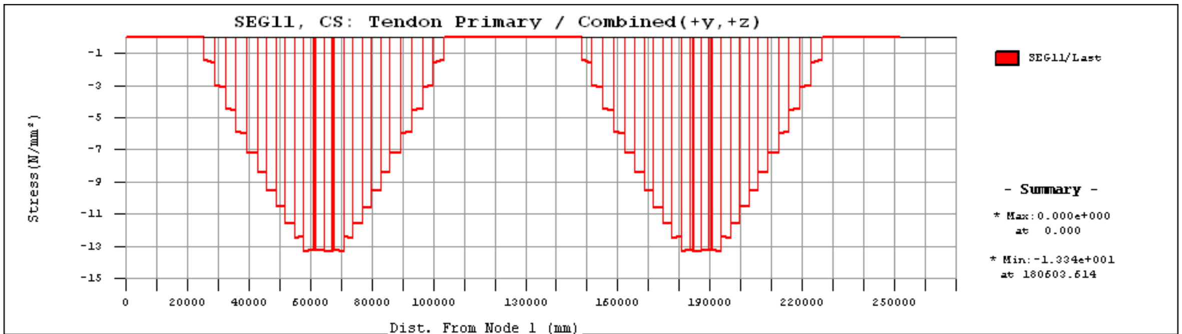

SEG10, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:1.360e-004
at 54843.822
* Min:-4.441e-003
at 61349.020

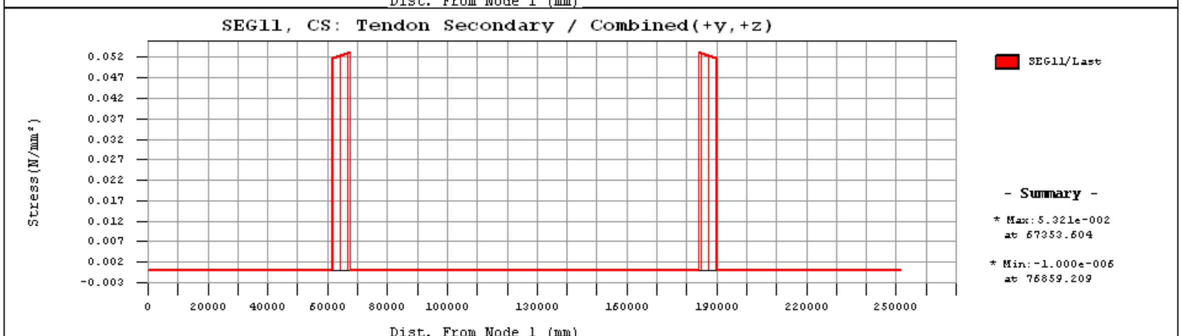

SEG10, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-7.404e+000
at 57846.222

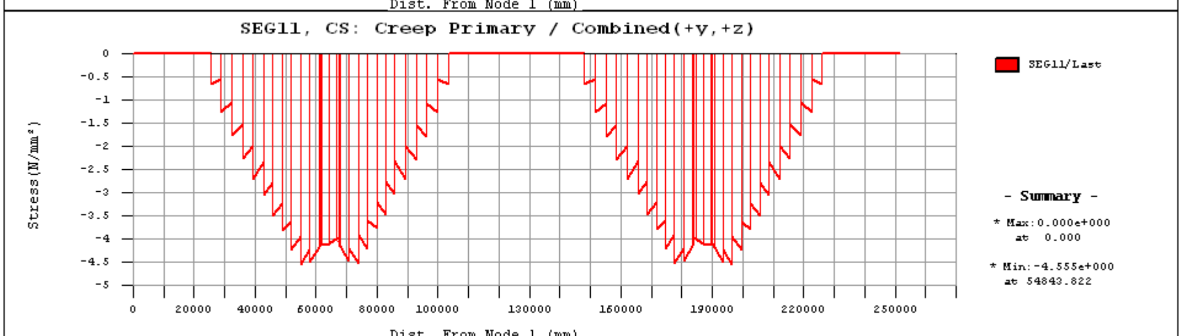
SEGMENT-11

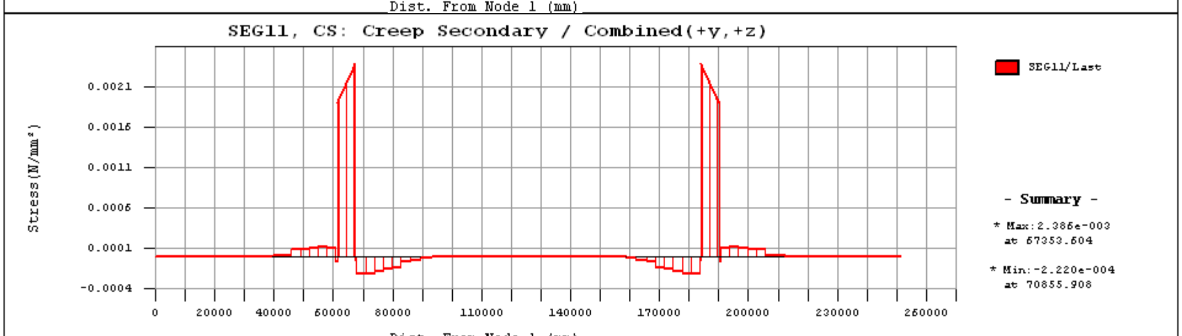

SEG11, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max:5.872e+000
at 67353.604
* Min:0.000e+000
at 0.000

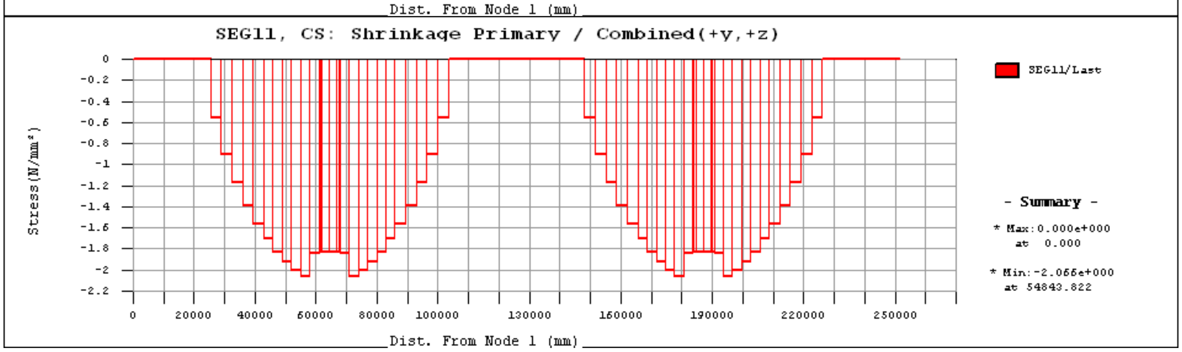

SEG11, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max:7.612e-001
at 61349.020
* Min:-4.480e-003
at 103366.404

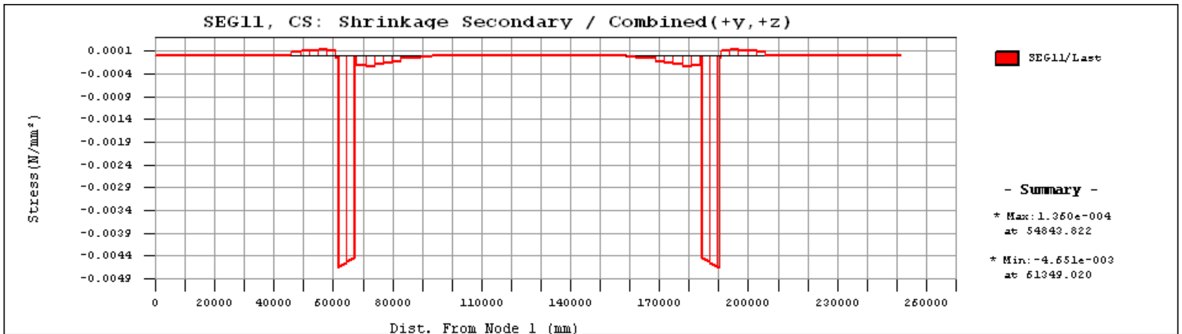

SEG11, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.334e+001
at 180603.614

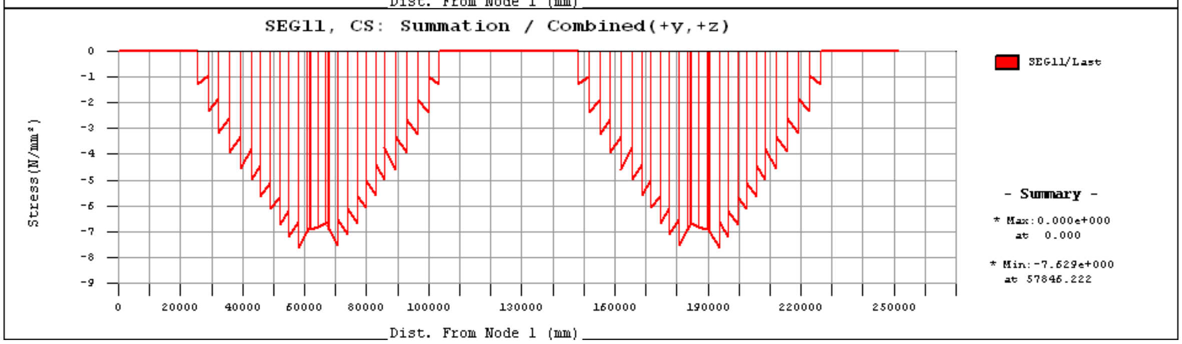

SEG11, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max:5.321e-002
at 67353.604
* Min:-1.000e-006
at 76859.209


SEG11, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-4.555e+000
at 54843.822

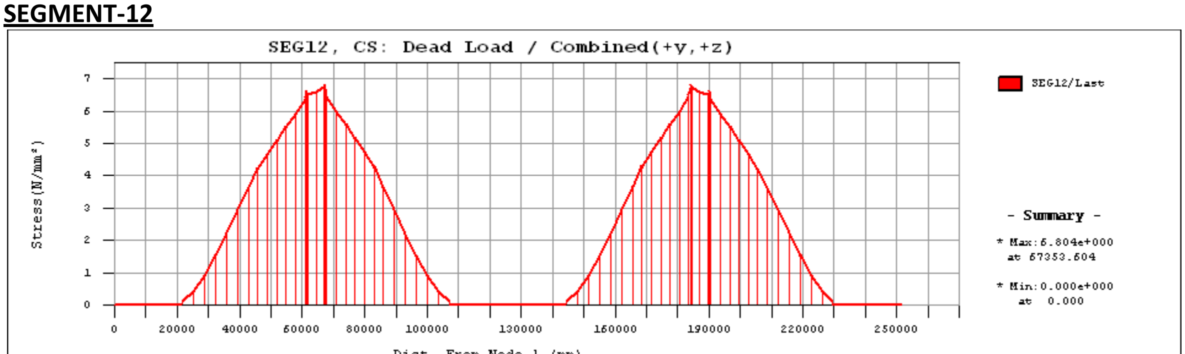

SEG11, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max:2.386e-003
at 67353.604
* Min:-2.220e-004
at 70855.908

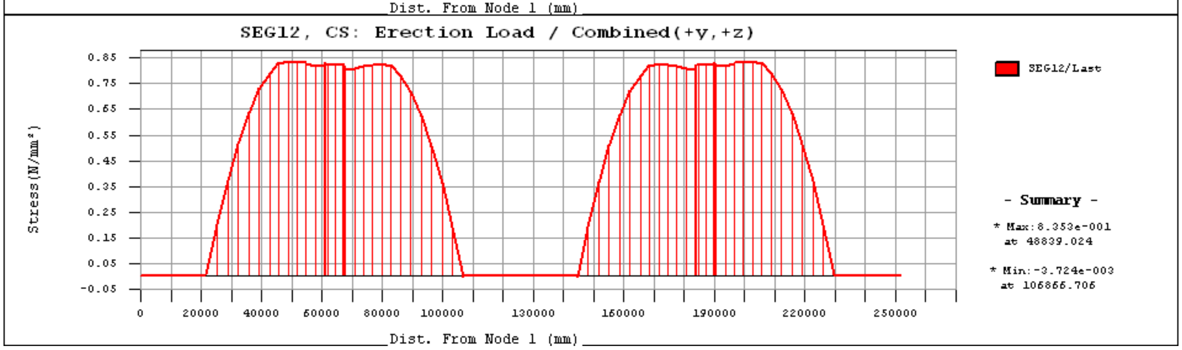

SEG11, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.066e+000
at 54843.822

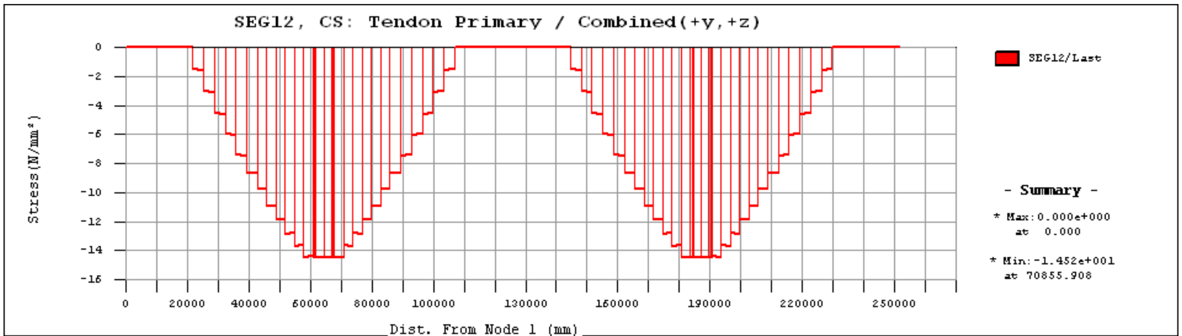

SEG11, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max:1.360e-004 at 54843.822
* Min:-4.651e-003 at 61349.020

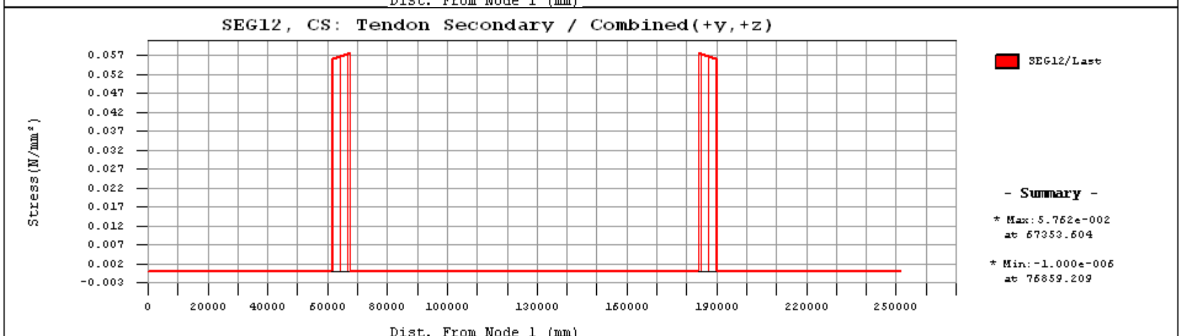

SEG11, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max:0.000e+000 at 0.000
* Min:-7.629e+000 at 57846.222

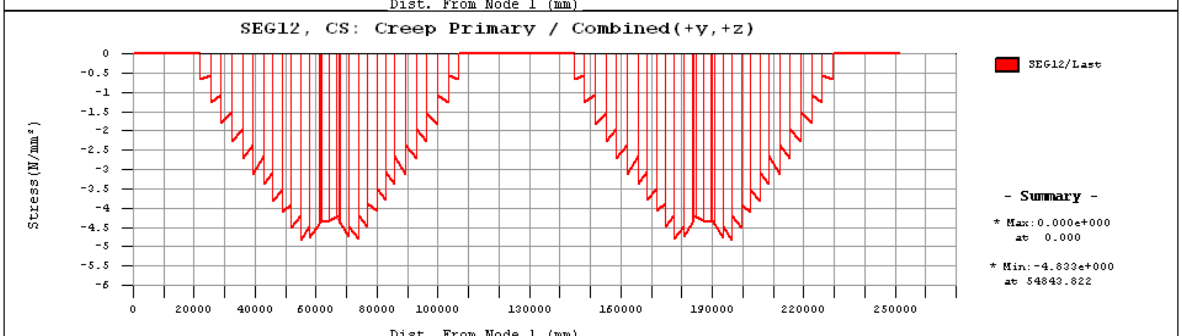
SEGMENT-12

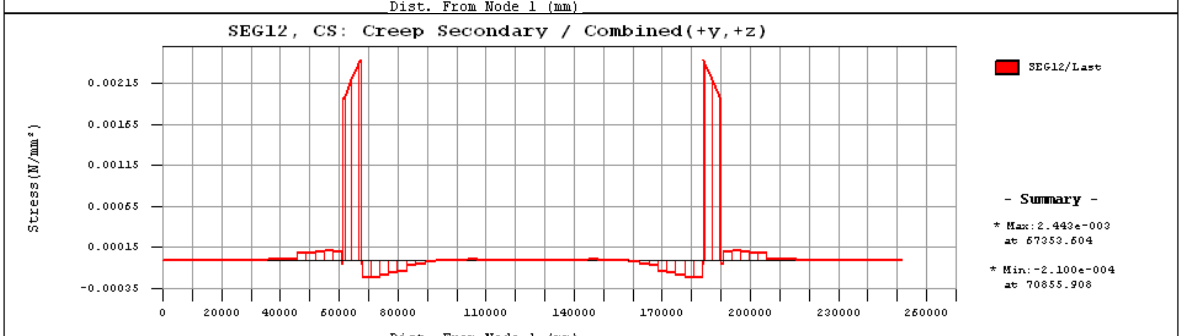

SEG12, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:6.804e+000 at 67353.604
* Min:0.000e+000 at 0.000

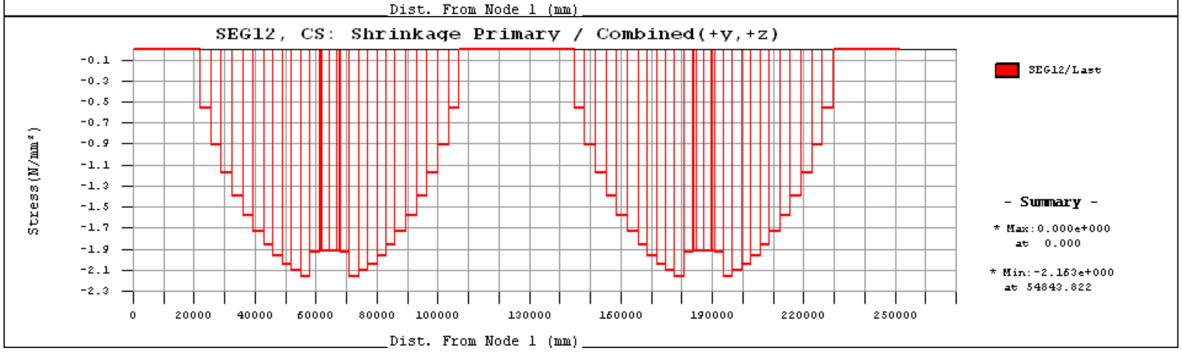

SEG12, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:8.353e-001 at 48839.024
* Min:-3.724e-003 at 106866.706

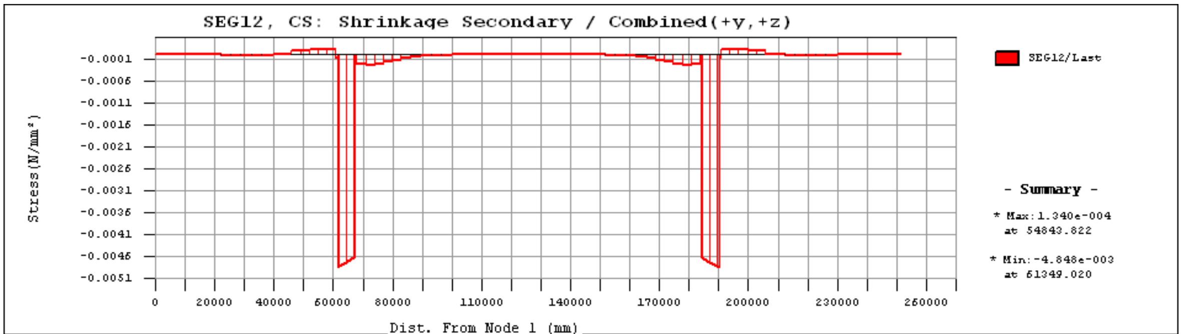

SEG12, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.452e+001
at 70855.908

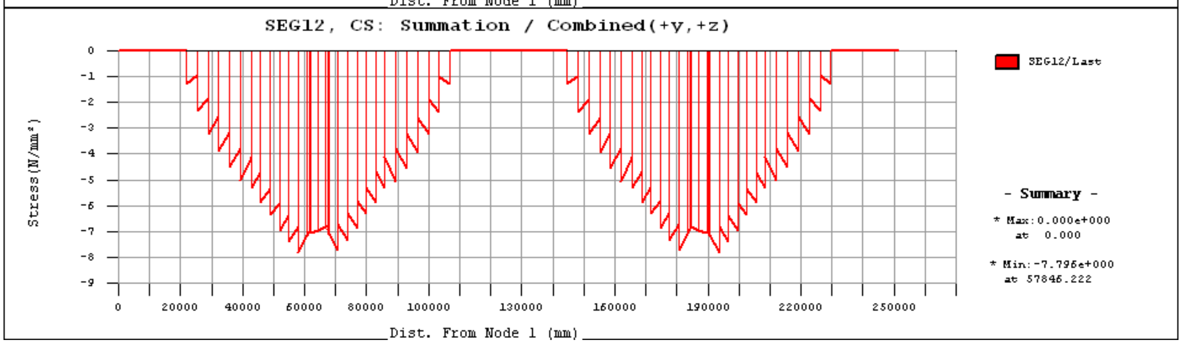

SEG12, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:5.762e-002
at 67353.604
* Min:-1.000e-006
at 76859.209


SEG12, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-4.833e+000
at 54843.822

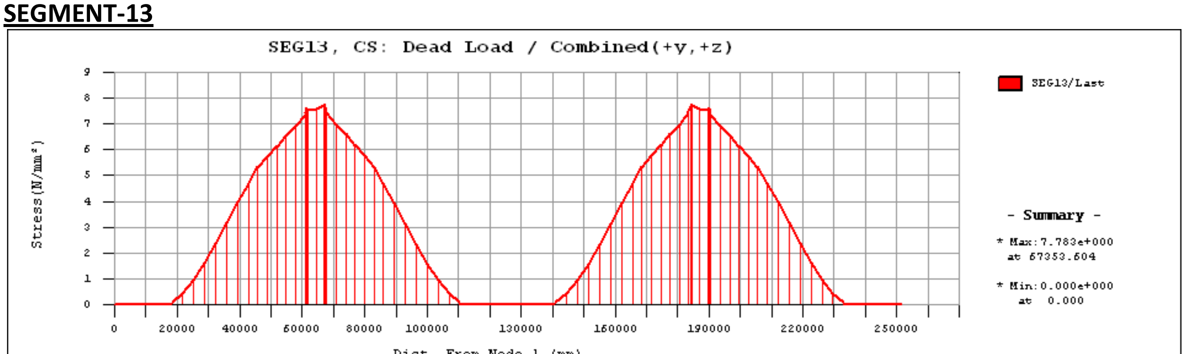

SEG12, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:2.443e-003
at 67353.604
* Min:-2.100e-004
at 70855.908

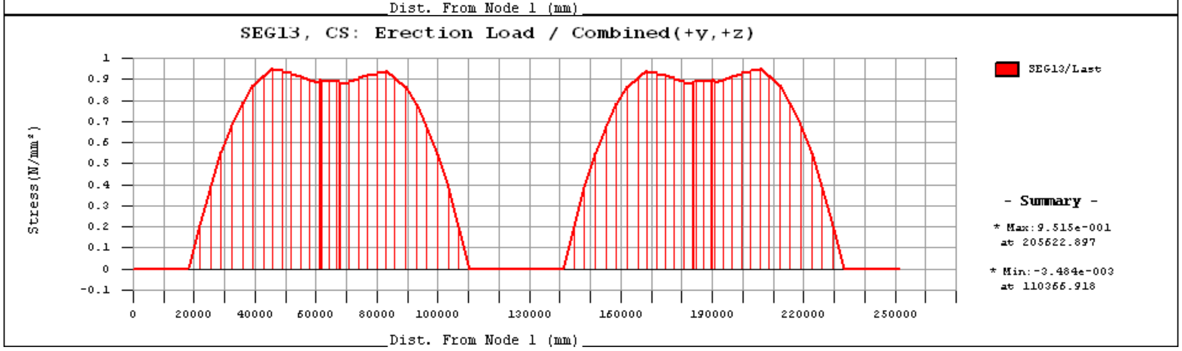

SEG12, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.163e+000
at 54843.822

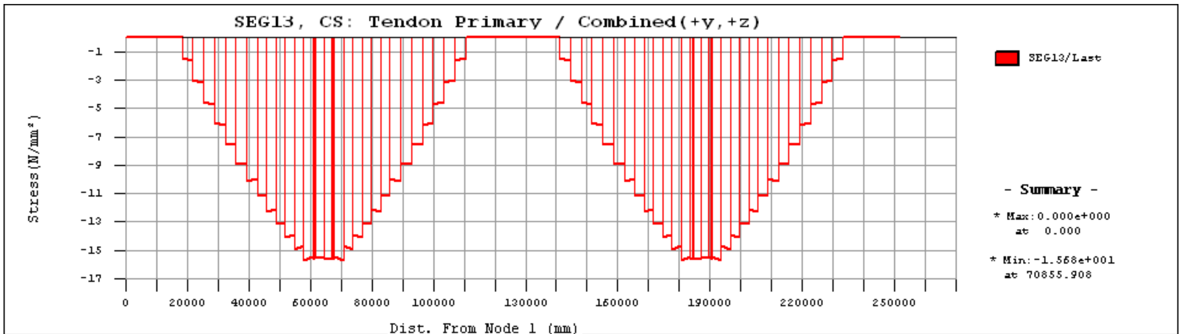

SEG12, CS: Shrinkage Secondary / Combined(+y,+z)
SEG12/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 1.340e-004
at 54843.822
* Min: -4.848e-003
at 61349.020

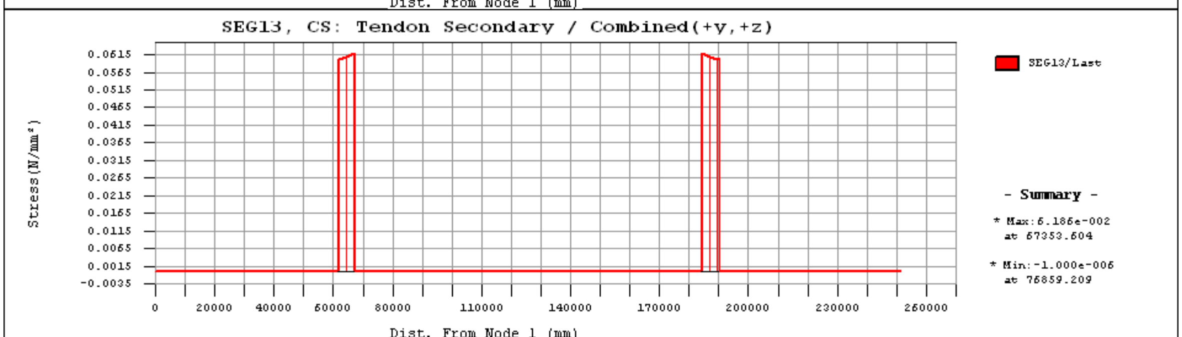

SEG12, CS: Summation / Combined(+y,+z)
SEG12/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -7.796e+000
at 57846.222

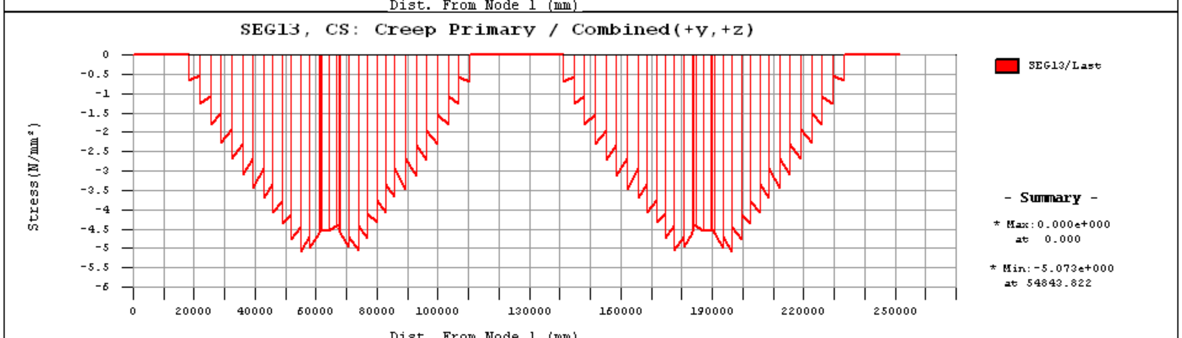
SEGMENT-13

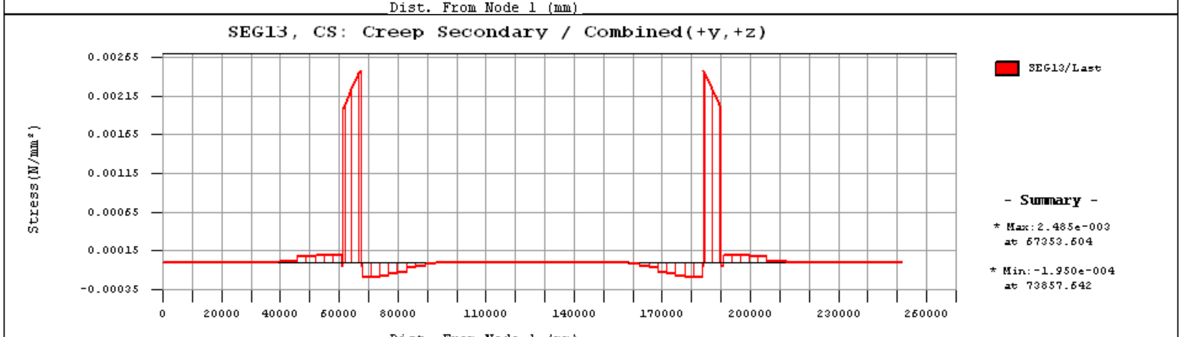

SEG13, CS: Dead Load / Combined(+y,+z)
SEG13/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 7.783e+000
at 67353.604
* Min: 0.000e+000
at 0.000

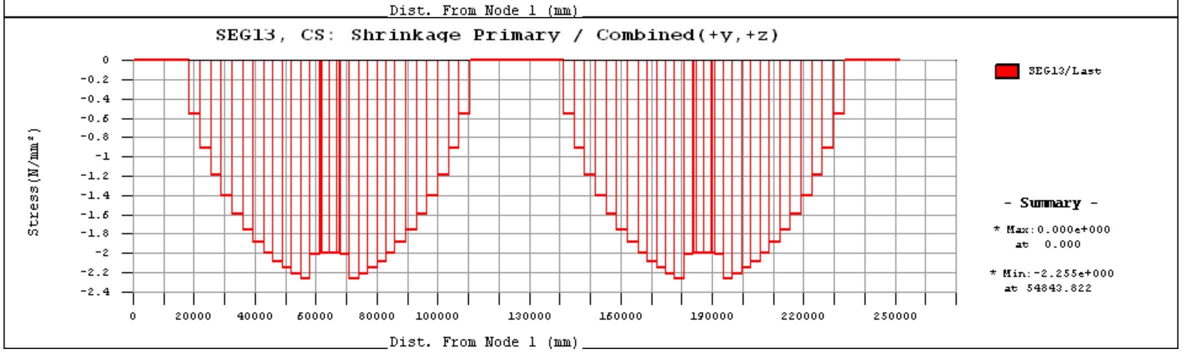

SEG13, CS: Erection Load / Combined(+y,+z)
SEG13/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 9.515e-001
at 205622.897
* Min: -3.484e-003
at 110366.918

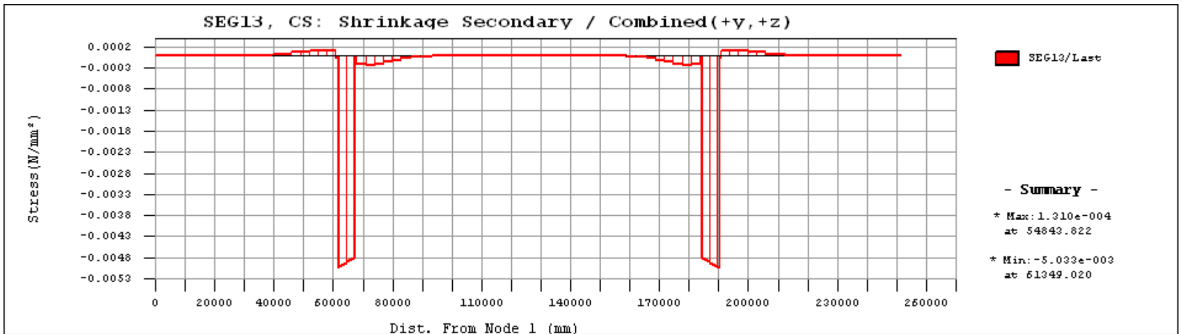

SEG13, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.568e+001
at 70855.908


SEG13, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:6.186e-002
at 67353.604
* Min:-1.000e-006
at 76859.209

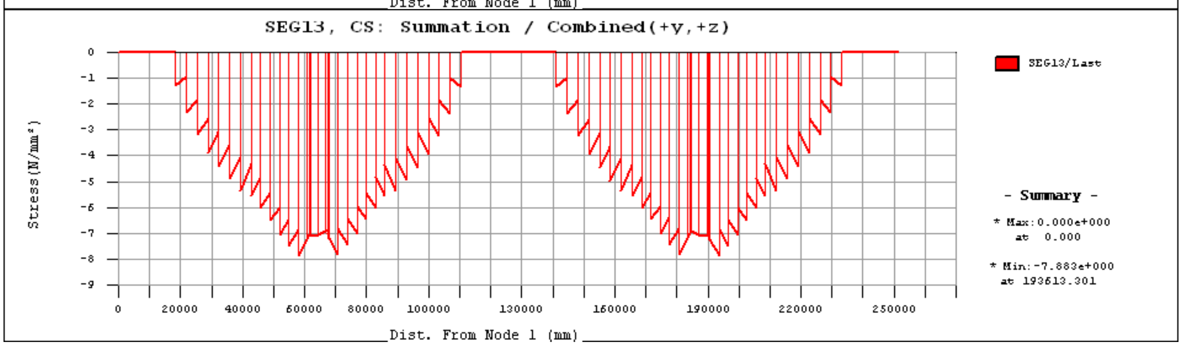

SEG13, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-5.073e+000
at 54843.822


SEG13, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:2.485e-003
at 67353.604
* Min:-1.950e-004
at 73857.642


SEG13, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.255e+000
at 54843.822

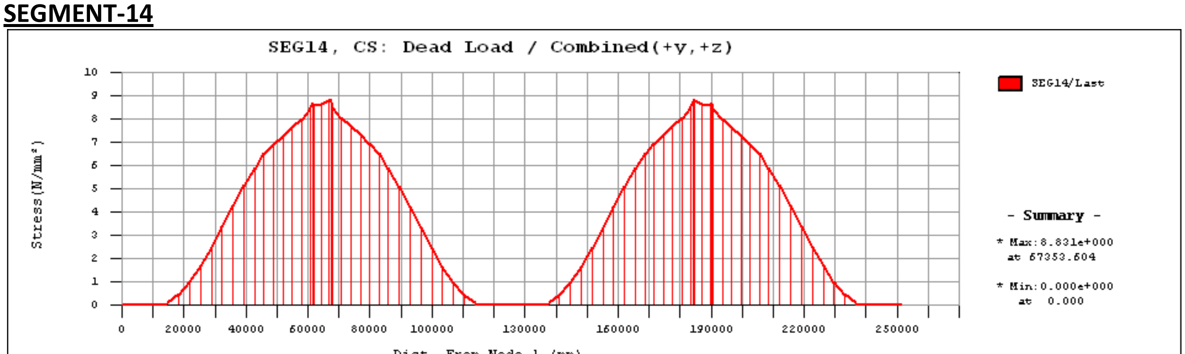


SEG13, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:1.310e-004 at 54843.822
* Min:-5.033e-003 at 61349.020

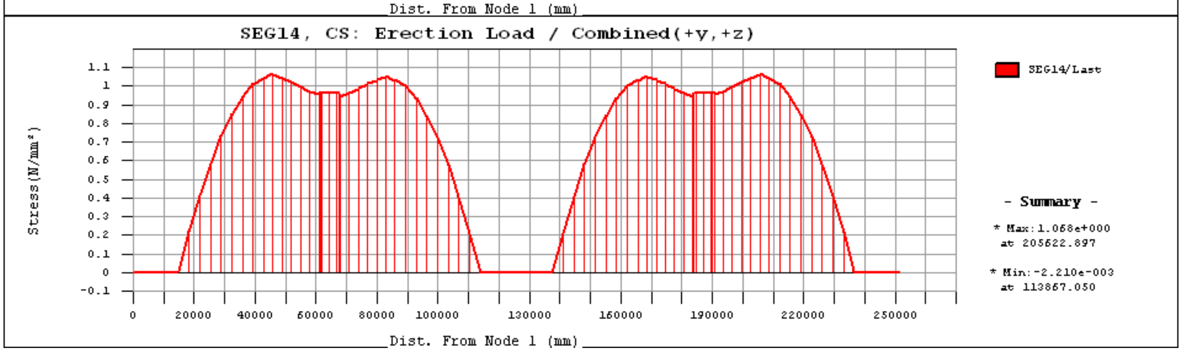


SEG13, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:0.000e+000 at 0.000
* Min:-7.883e+000 at 193513.301

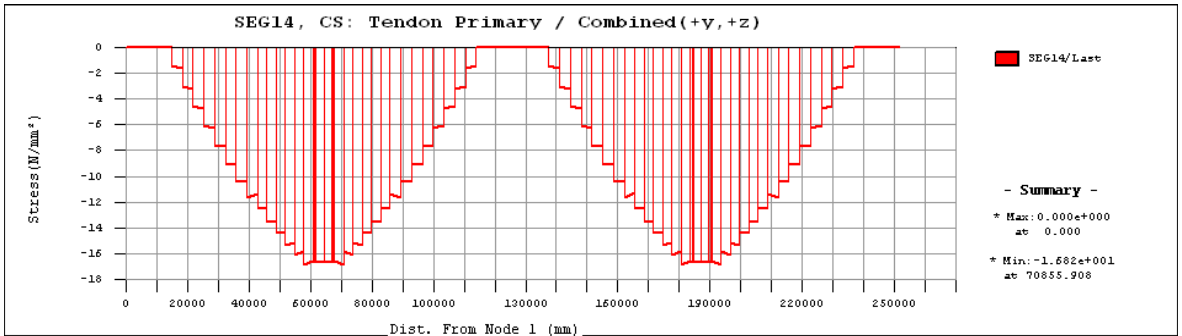
SEGMENT-14

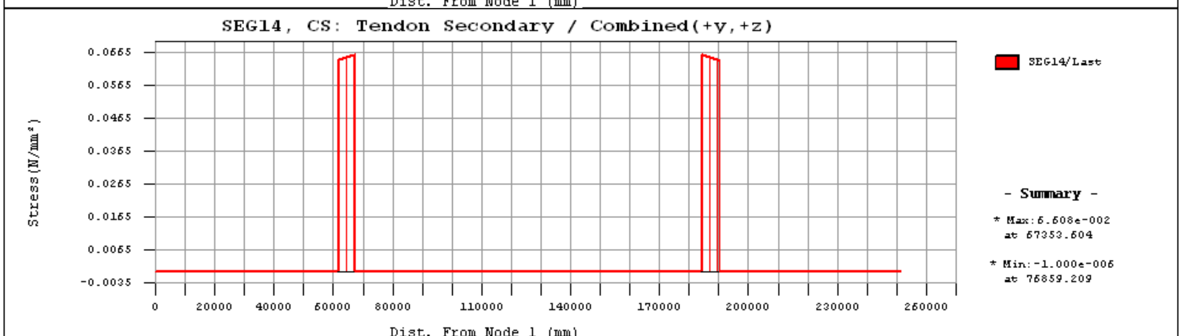


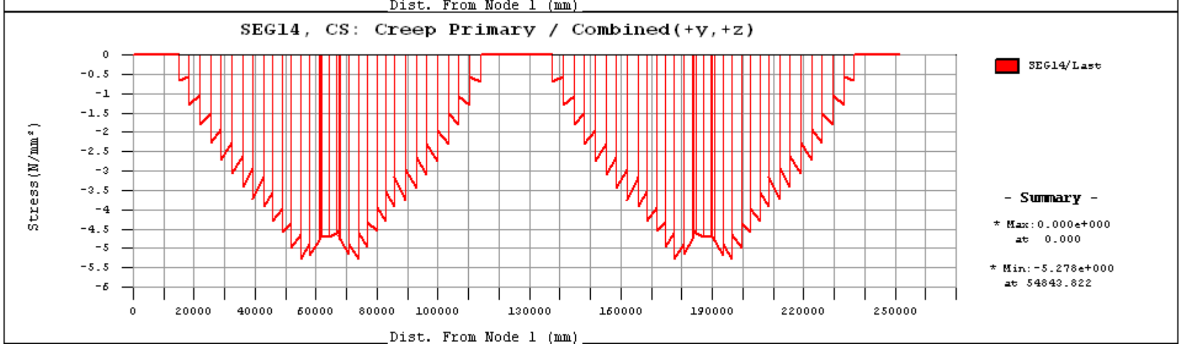
SEG14, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max:8.831e+000 at 67353.604
* Min:0.000e+000 at 0.000

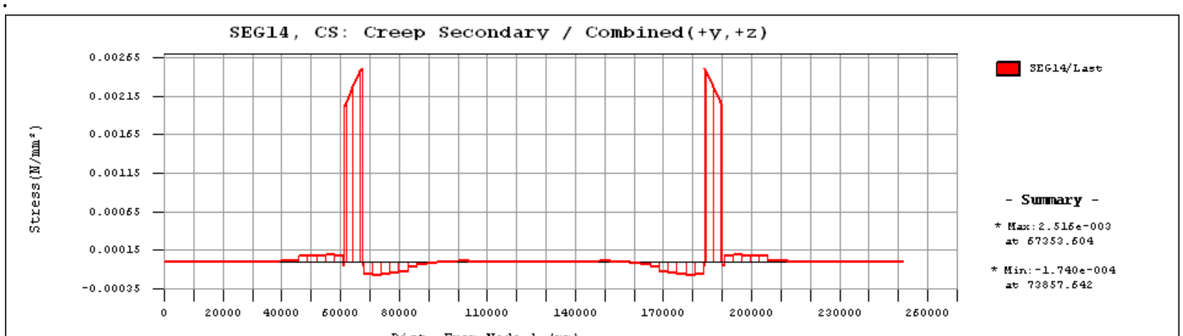


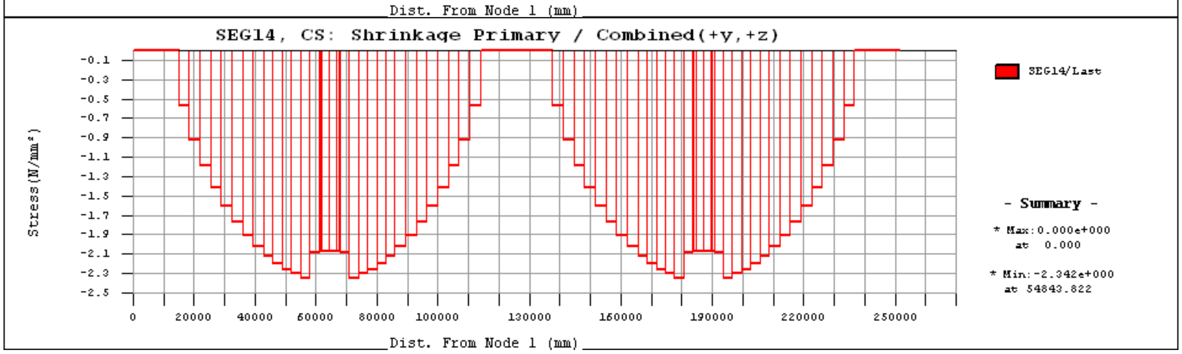
SEG14, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max:1.068e+000 at 205622.897
* Min:-2.210e-003 at 113867.050

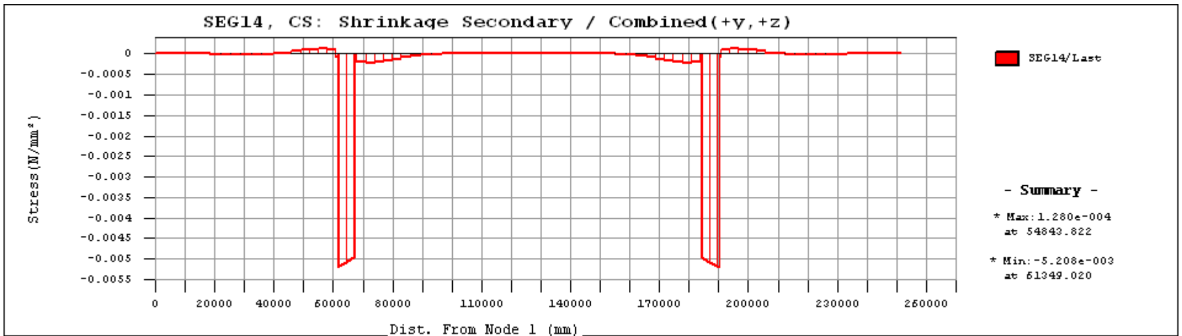

SEG14, CS: Tendon Primary / Combined(+y,+z)
SEG14/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.682e+001
at 70855.908

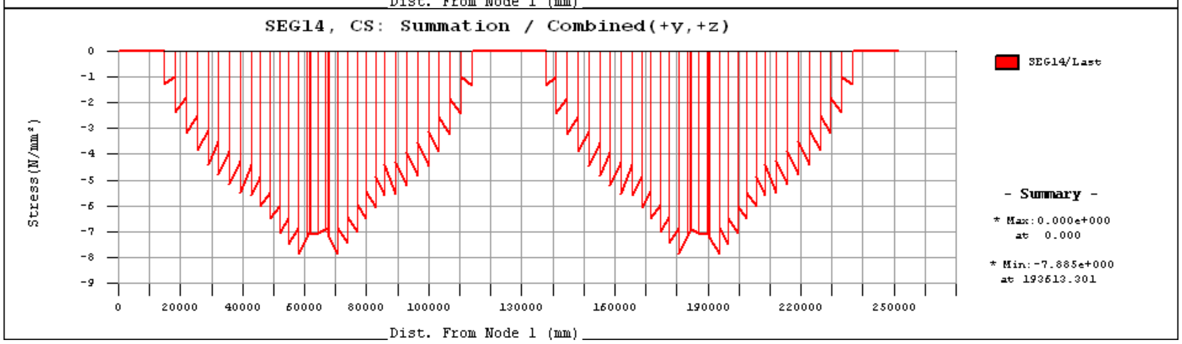

SEG14, CS: Tendon Secondary / Combined(+y,+z)
SEG14/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:6.608e-002
at 67353.604
* Min:-1.000e-006
at 76859.209


SEG14, CS: Creep Primary / Combined(+y,+z)
SEG14/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-5.278e+000
at 54843.822

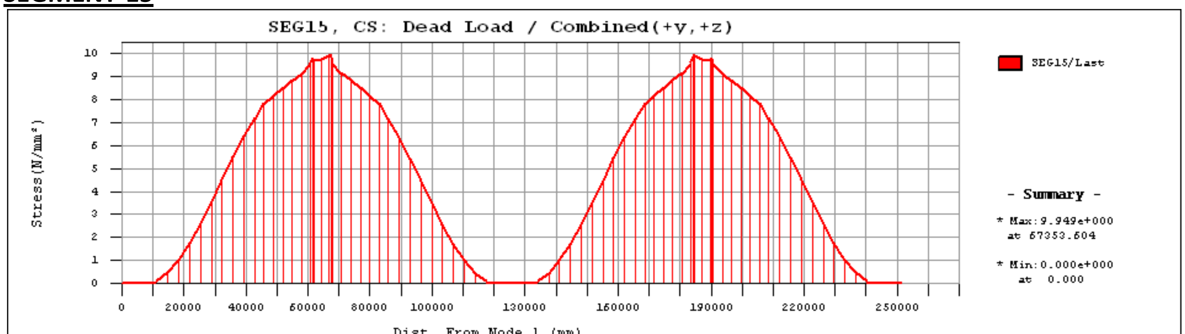

SEG14, CS: Creep Secondary / Combined(+y,+z)
SEG14/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:2.516e-003
at 67353.604
* Min:-1.740e-004
at 73857.642

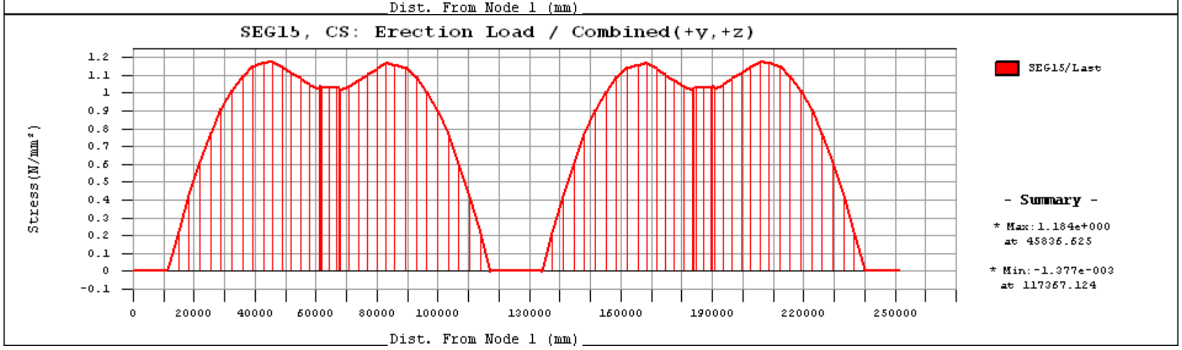

SEG14, CS: Shrinkage Primary / Combined(+y,+z)
SEG14/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.342e+000
at 54843.822

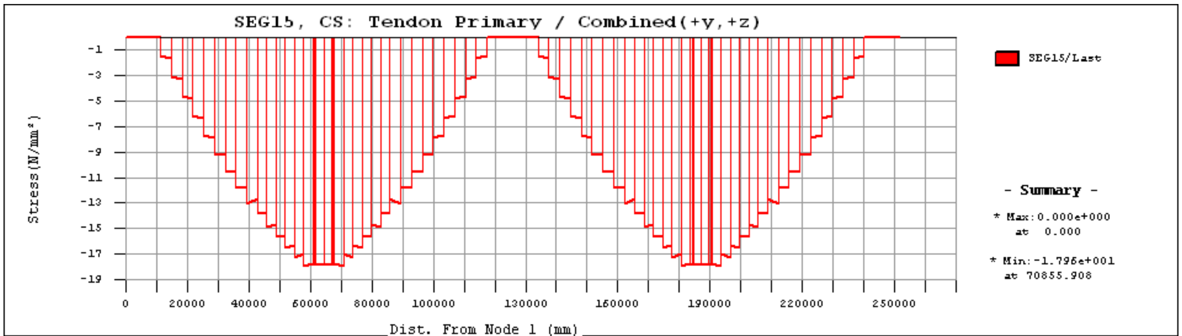

SEG14, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max: 1.280e-004 at 54843.822
* Min: -5.208e-003 at 61349.020

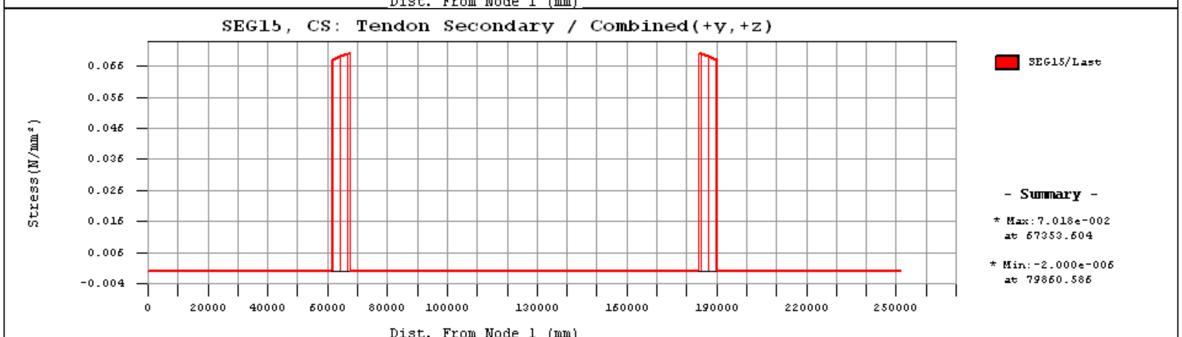

SEG14, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -7.885e+000 at 193613.301

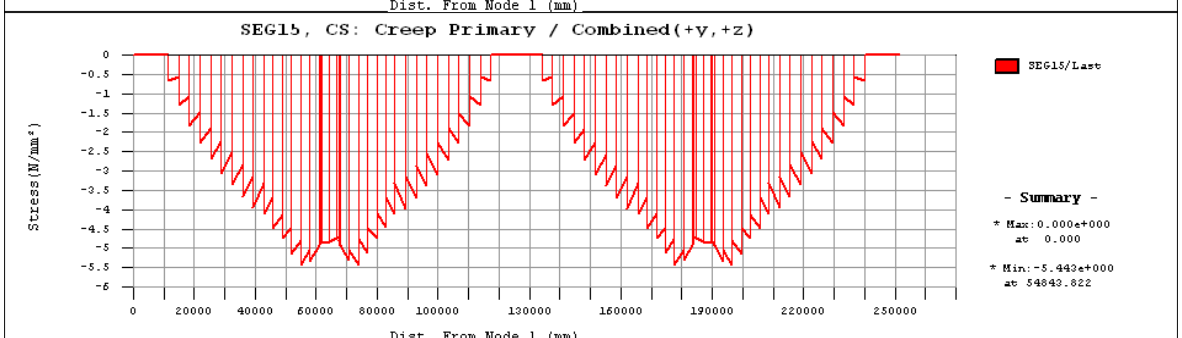
SEGMENT-15

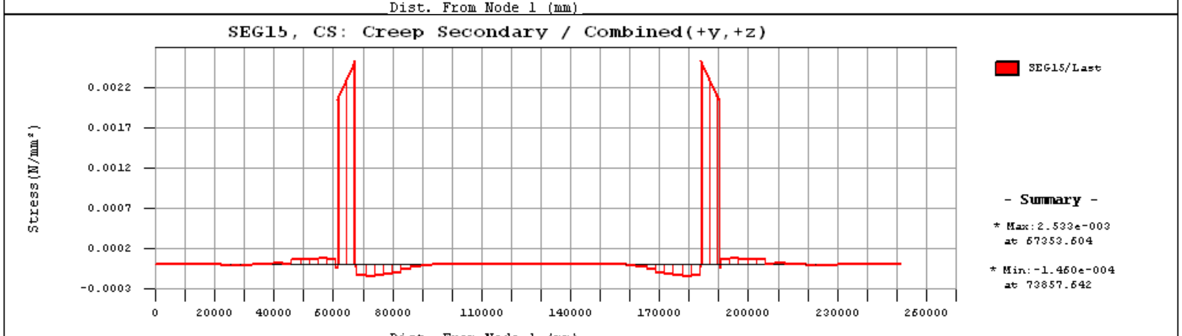

SEG15, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 9.949e+000 at 67353.604
* Min: 0.000e+000 at 0.000

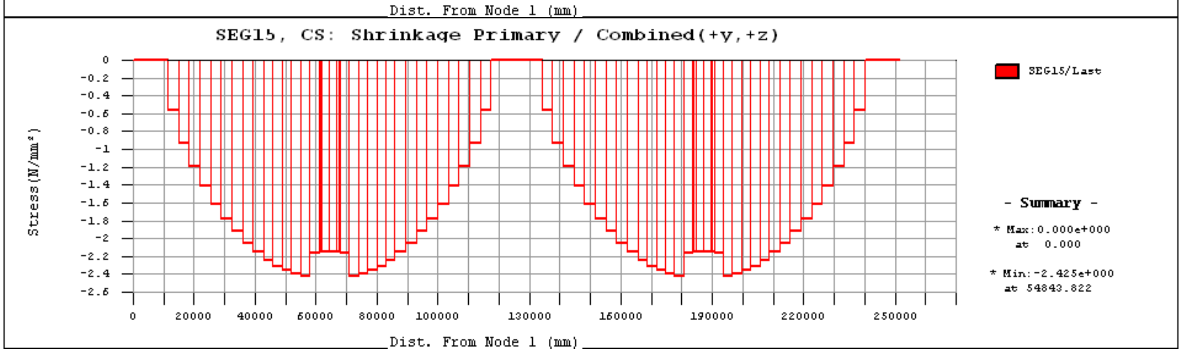

SEG15, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 1.184e+000 at 45836.625
* Min: -1.377e-003 at 117367.124

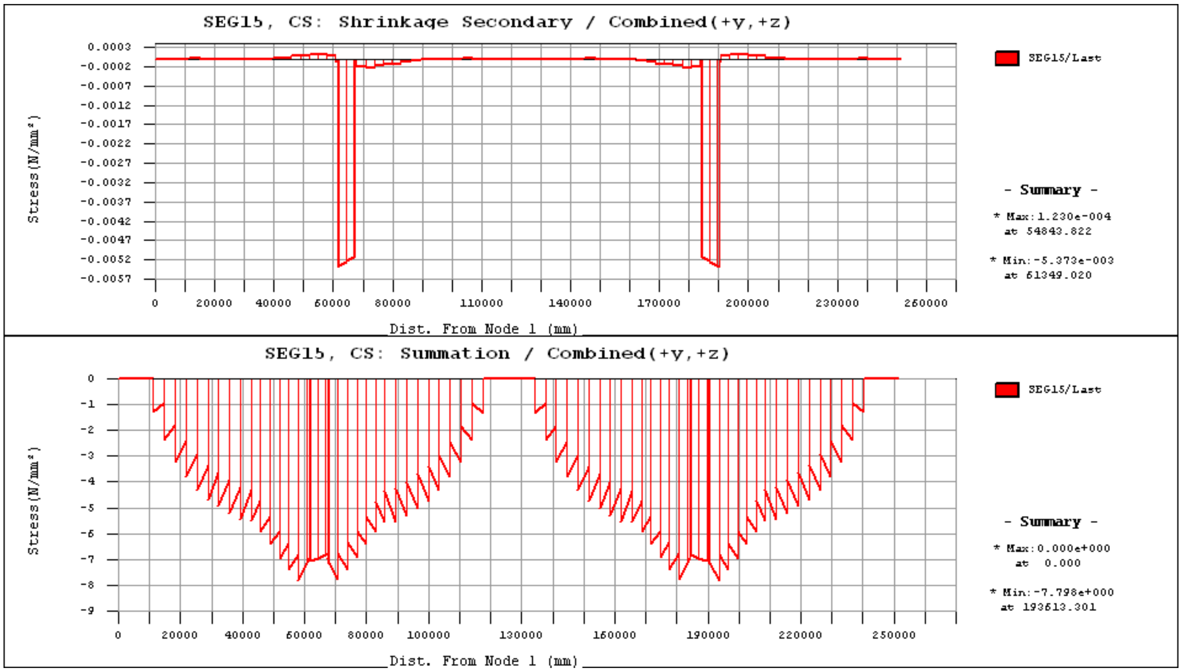

SEG15, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -1.796e+001
at 70855.908


SEG15, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 7.018e-002
at 67353.604
* Min: -2.000e-006
at 79860.586

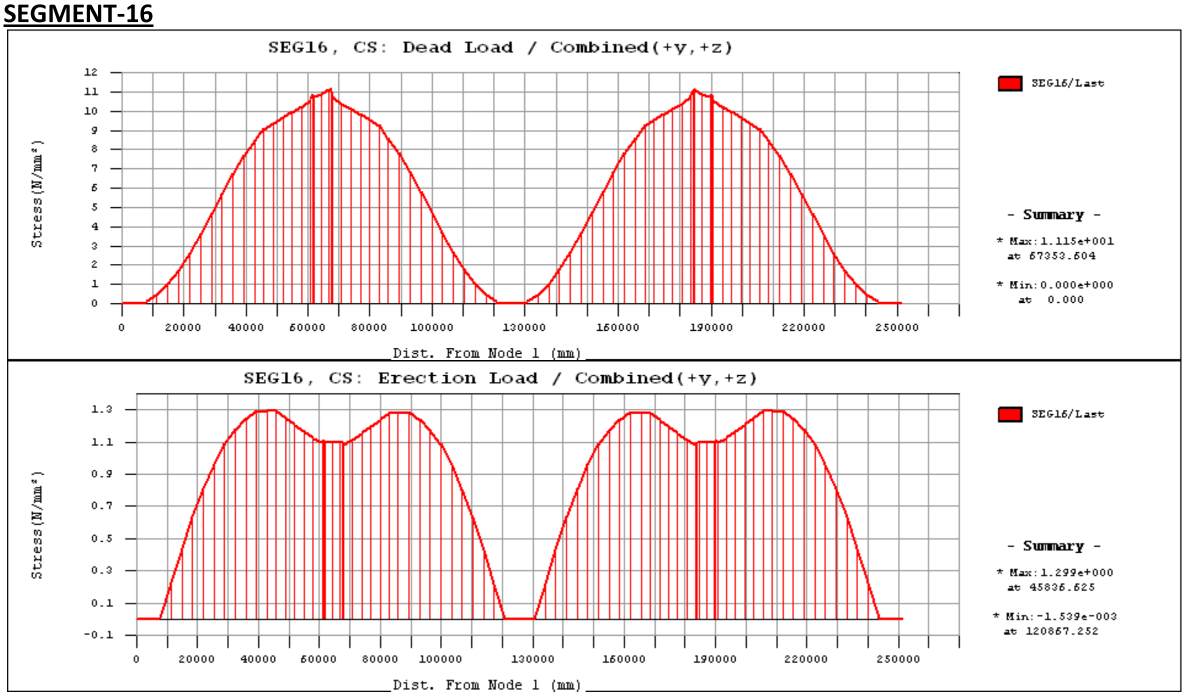

SEG15, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -5.443e+000
at 54843.822

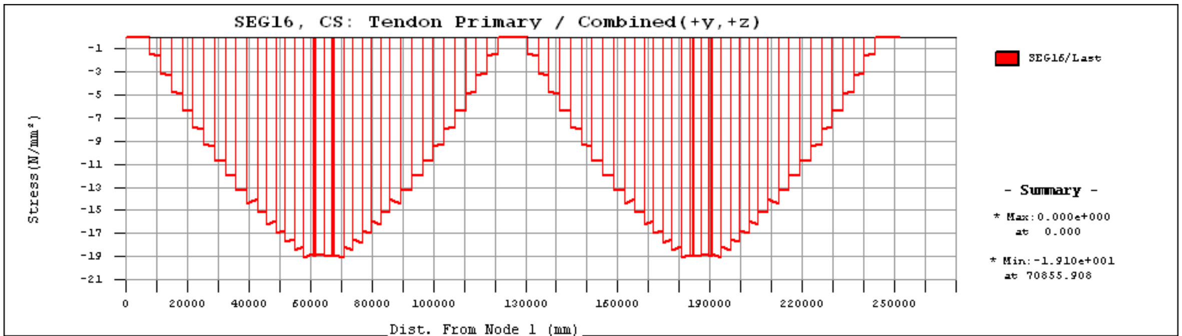

SEG15, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 2.533e-003
at 67353.604
* Min: -1.460e-004
at 73857.642

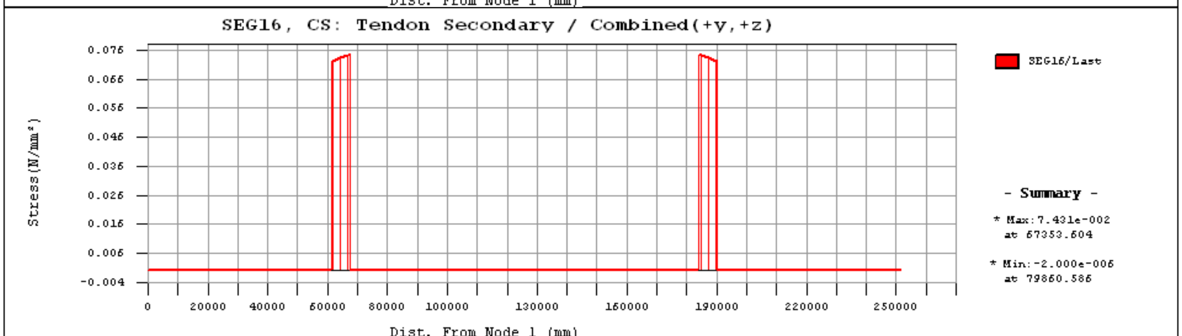

SEG15, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -2.425e+000
at 54843.822

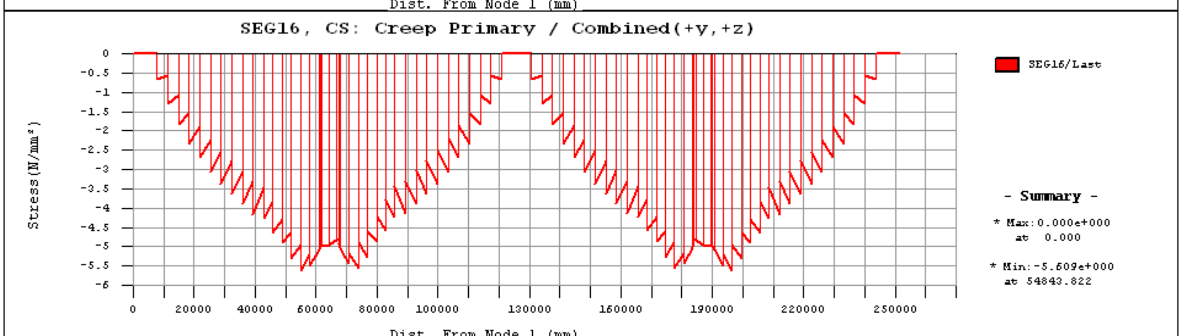

SEG15, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max:1.230e-004
at 54843.822
* Min:-5.373e-003
at 61349.020
SEG15, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-7.798e+000
at 193613.301

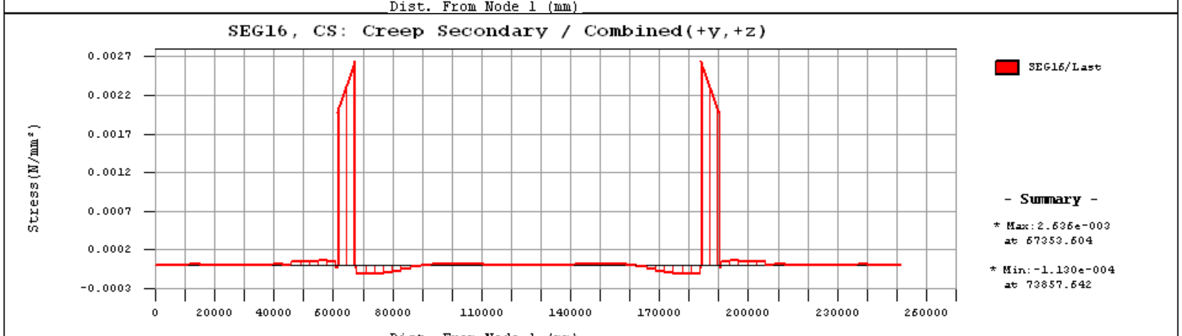
SEGMENT-16

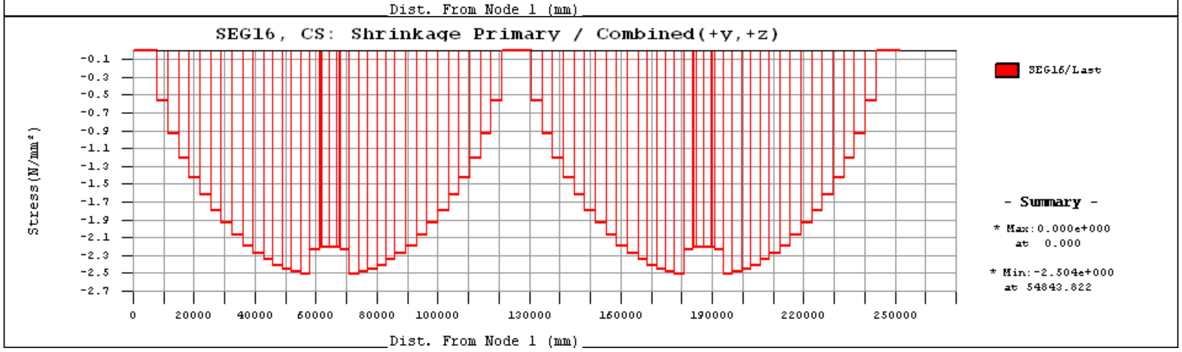

SEG16, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max:1.115e+001
at 67353.604
* Min:0.000e+000
at 0.000
SEG16, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max:1.299e+000
at 45836.625
* Min:-1.539e-003
at 120867.252

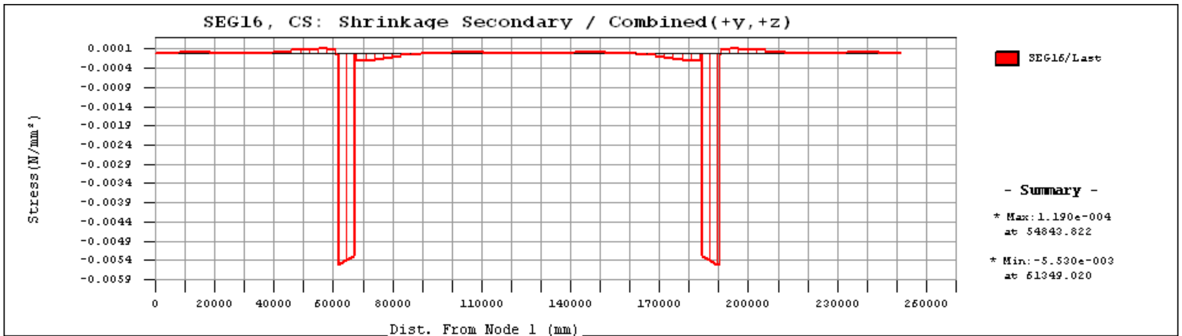

SEG16, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.910e+001
at 70855.908

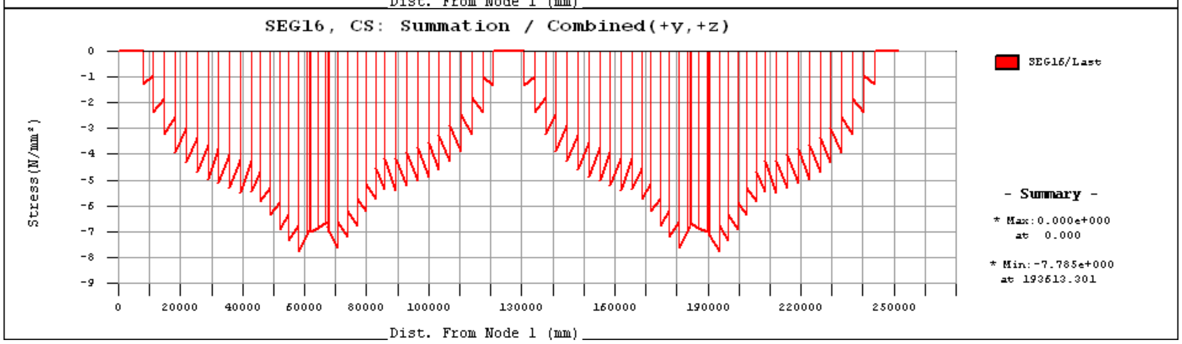

SEG16, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max:7.431e-002
at 67353.604
* Min:-2.000e-006
at 79860.586


SEG16, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-5.609e+000
at 54843.822

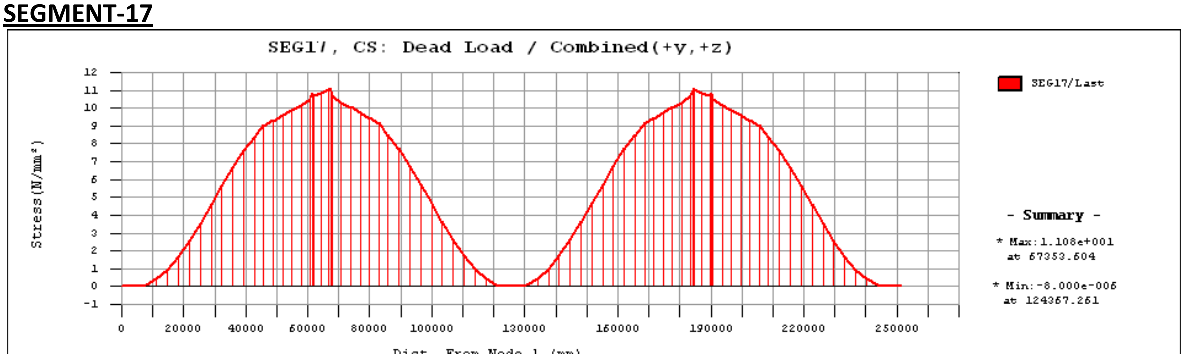

SEG16, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max:2.636e-003
at 67353.604
* Min:-1.130e-004
at 73857.642

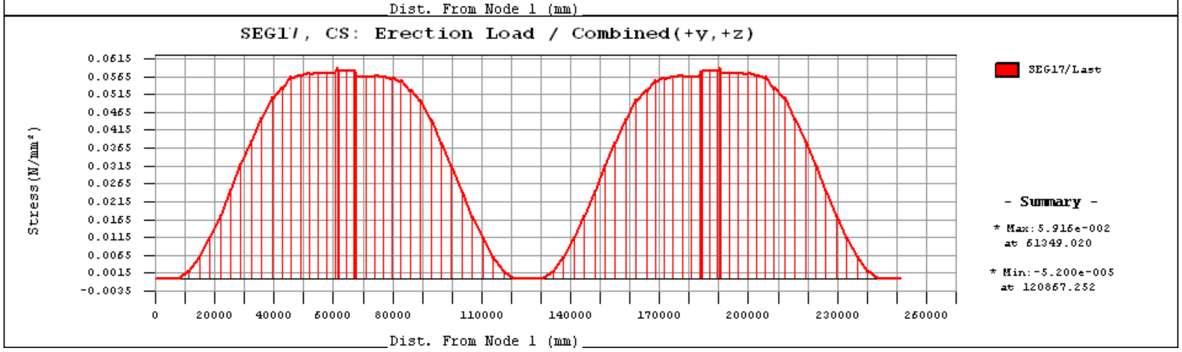

SEG16, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.504e+000
at 54843.822

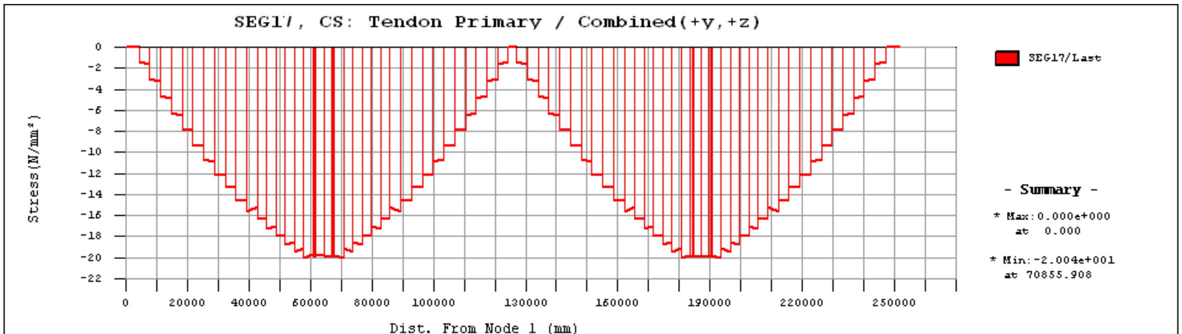

SEG16, CS: Shrinkage Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 1.190e-004
at 54843.822
* Min: -5.530e-003
at 61349.020

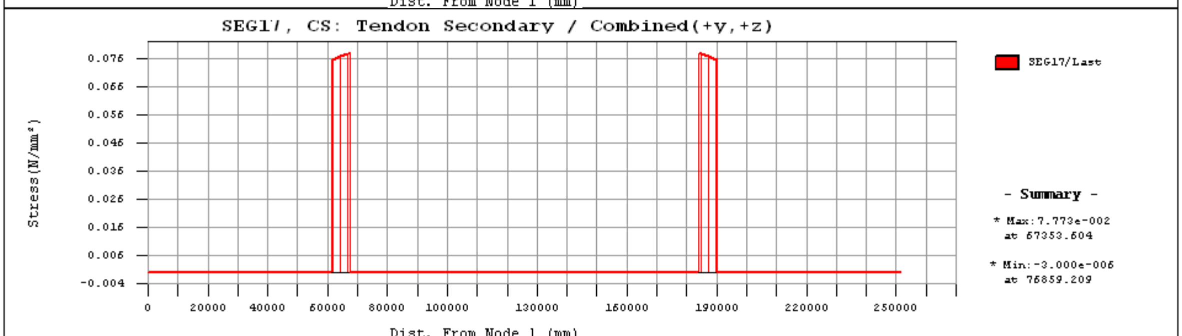

SEG16, CS: Summation / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -7.785e+000
at 193513.301

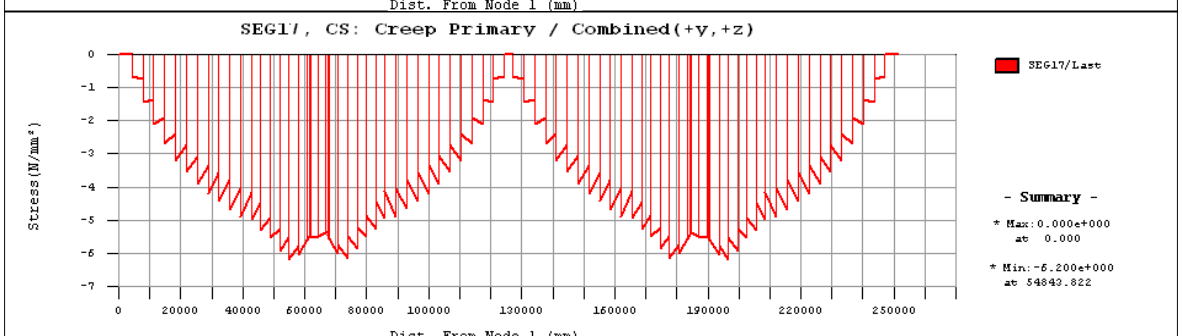
SEGMENT-17

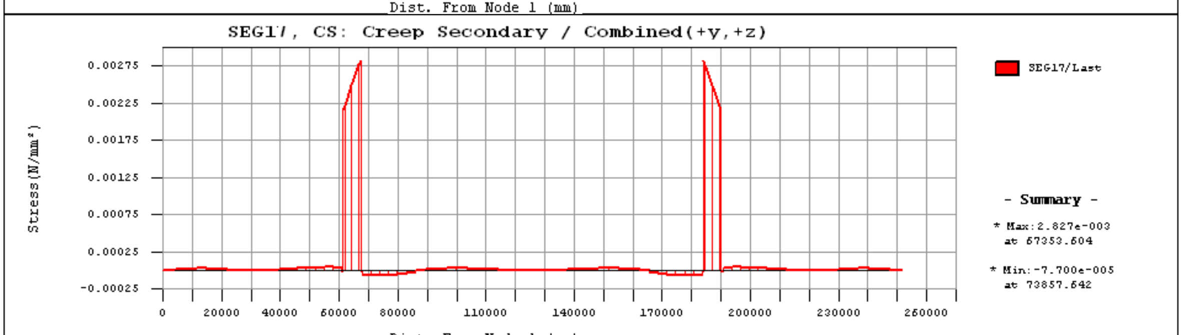

SEG17, CS: Dead Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max: 1.108e+001
at 67353.604
* Min: -8.000e-006
at 124367.261

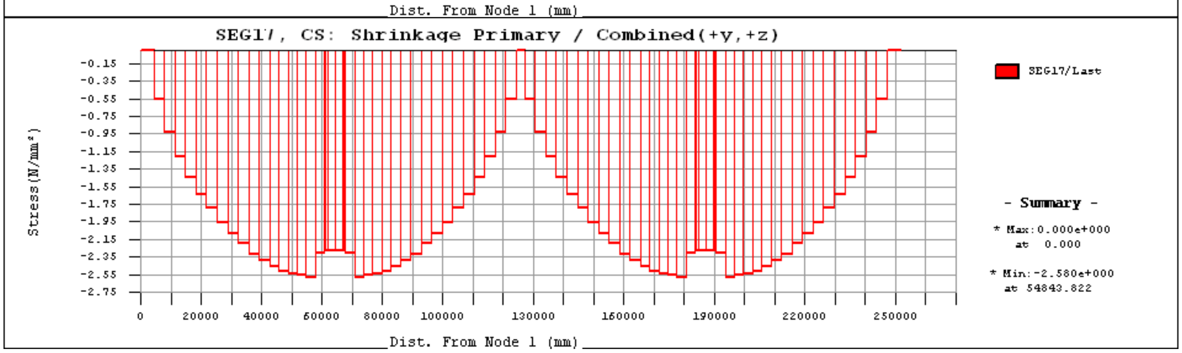

SEG17, CS: Erection Load / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max: 5.916e-002
at 61349.020
* Min: -5.200e-005
at 120867.252

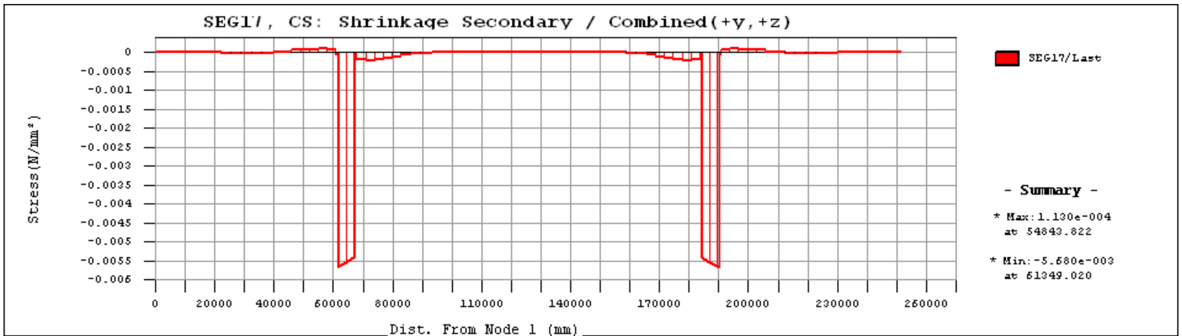

SEG17, CS: Tendon Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.004e+001
at 70855.908

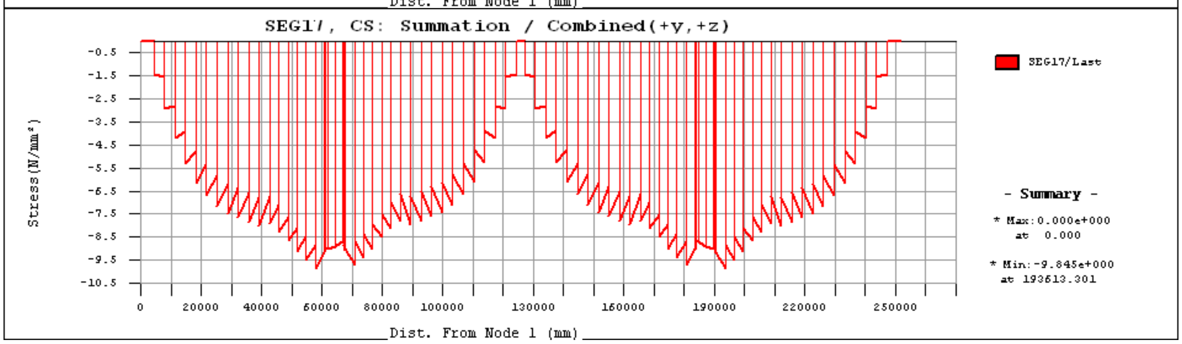

SEG17, CS: Tendon Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max:7.773e-002
at 67353.604
* Min:-3.000e-006
at 75859.209


SEG17, CS: Creep Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-6.200e+000
at 54843.822


SEG17, CS: Creep Secondary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max:2.827e-003
at 67353.604
* Min:-7.700e-005
at 73857.642

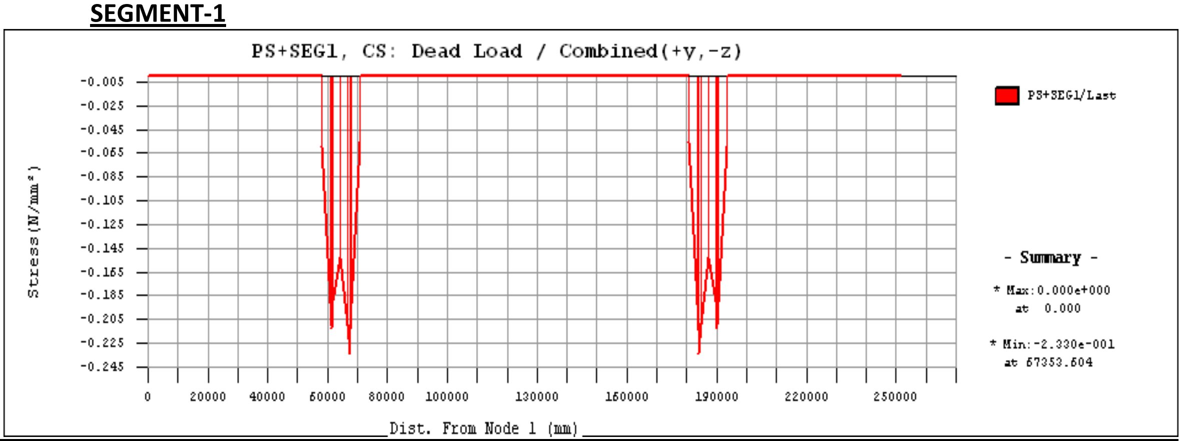

SEG17, CS: Shrinkage Primary / Combined(+y,+z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.580e+000
at 54843.822

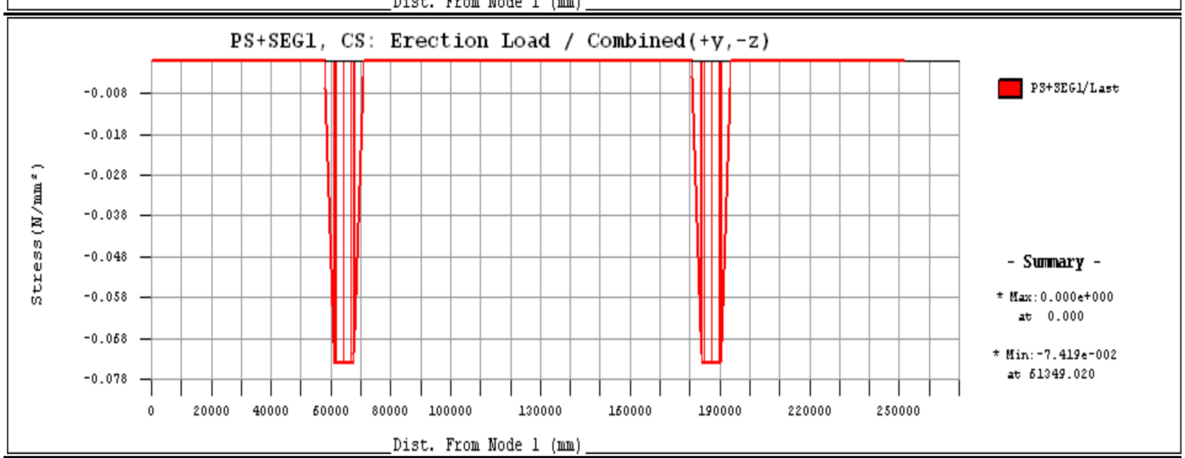


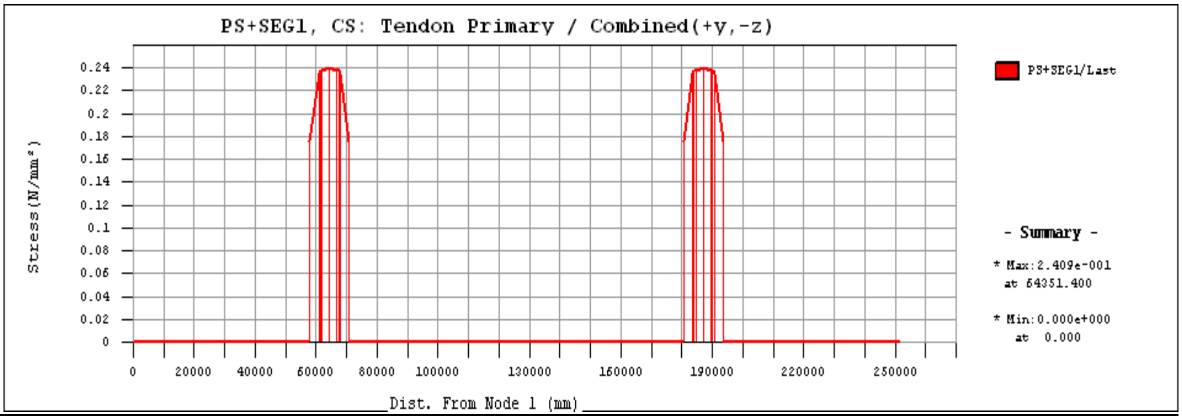


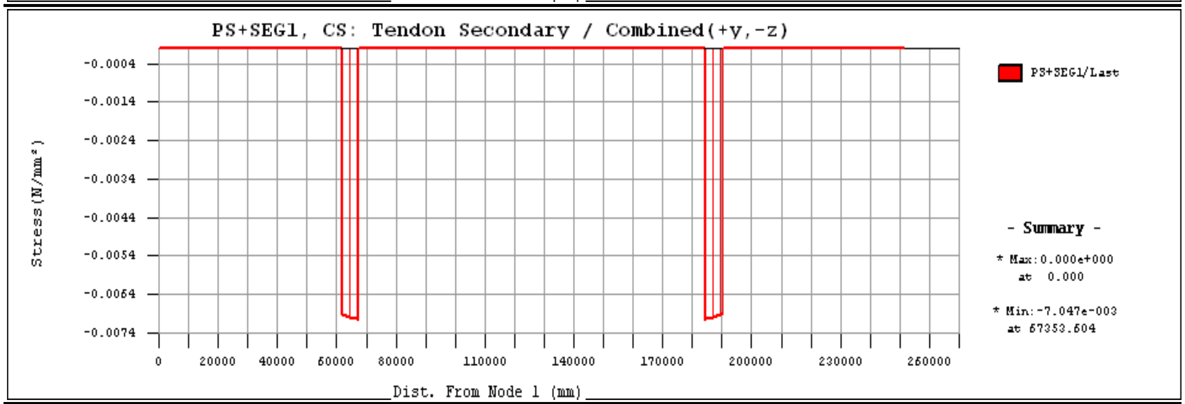
STRESS DIAGRAM FOR BOTTOM FIBRE AT DIFFERENT SEGMENTS

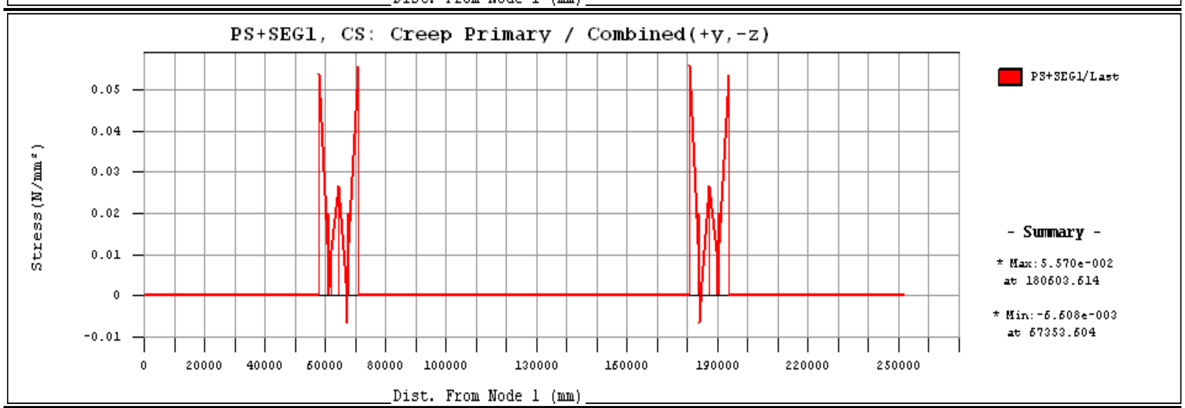
SEGMENT-1

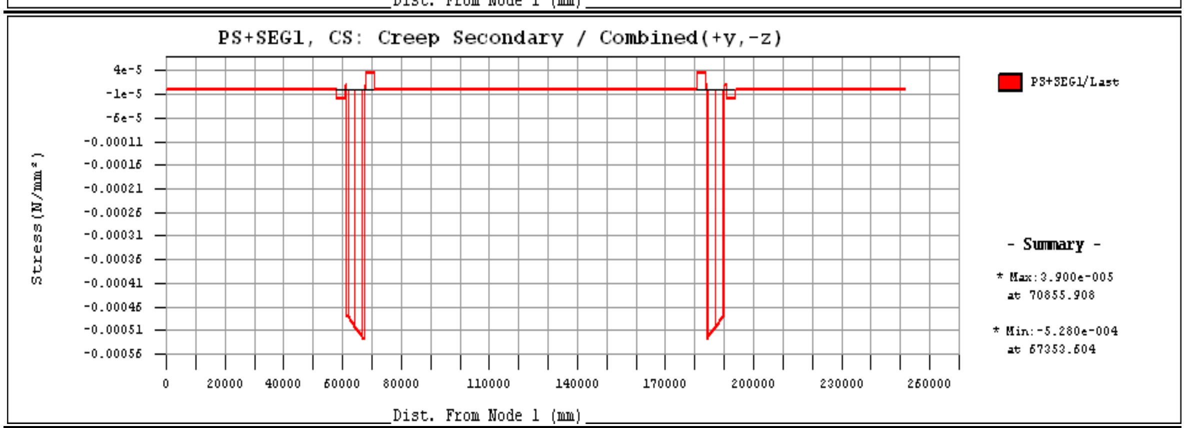


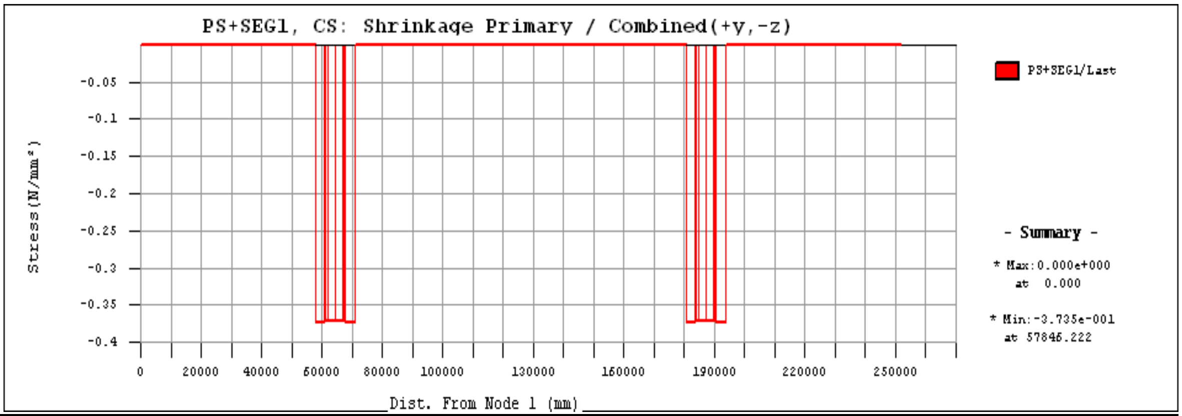


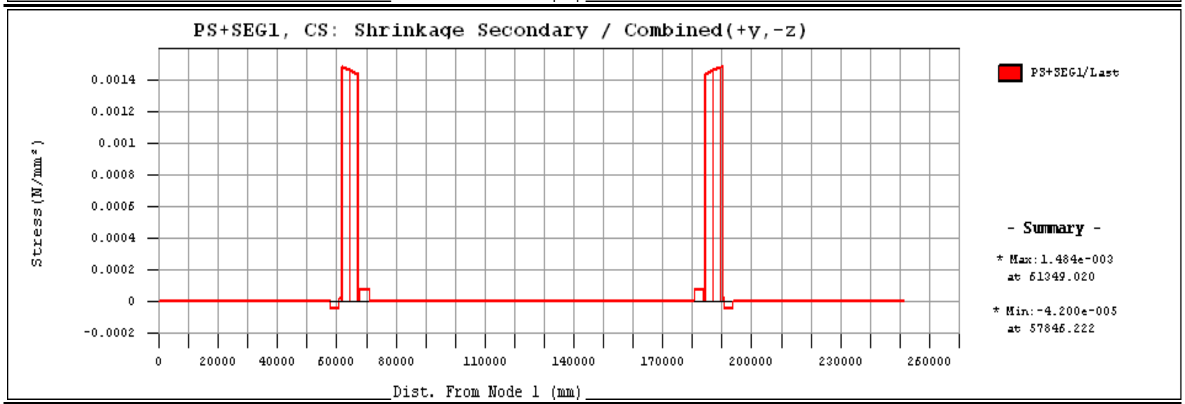

PS+SEG1, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
PS+SEG1/Last
- Summary -
* Max:2.409e-001
at 64351.400
* Min:0.000e+000
at 0.000

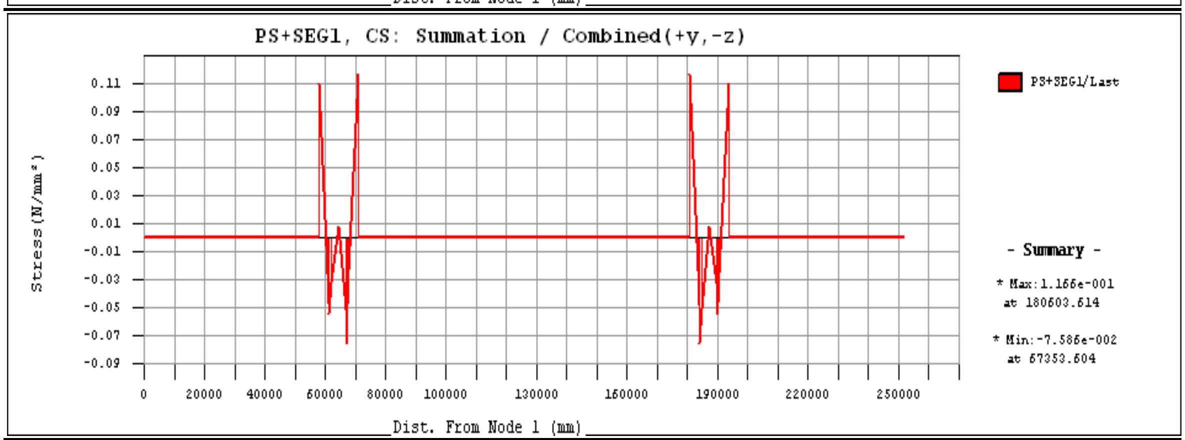

PS+SEG1, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
PS+SEG1/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-7.047e-003
at 67353.604


PS+SEG1, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
PS+SEG1/Last
- Summary -
* Max:5.570e-002
at 180603.614
* Min:-6.608e-003
at 67353.604

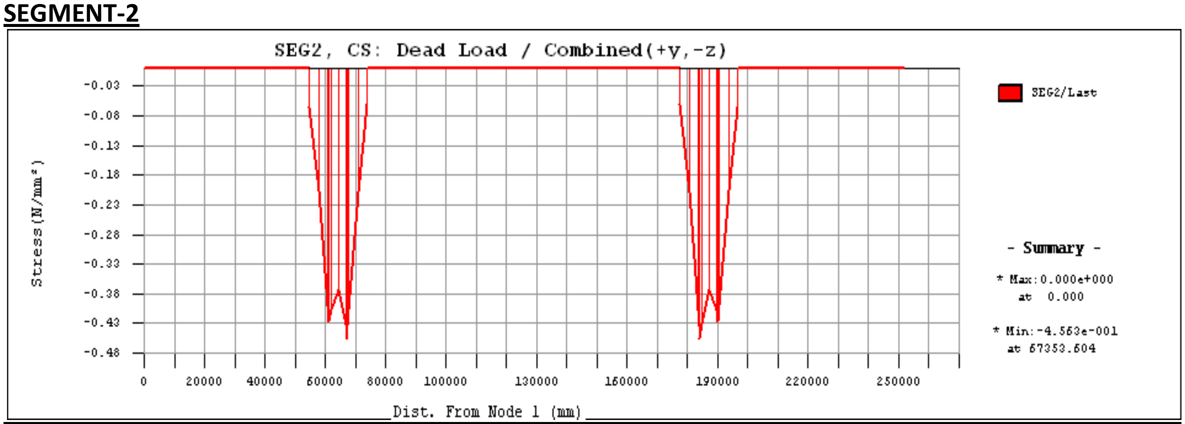

PS+SEG1, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
PS+SEG1/Last
- Summary -
* Max:3.900e-005
at 70855.908
* Min:-5.280e-004
at 67353.604

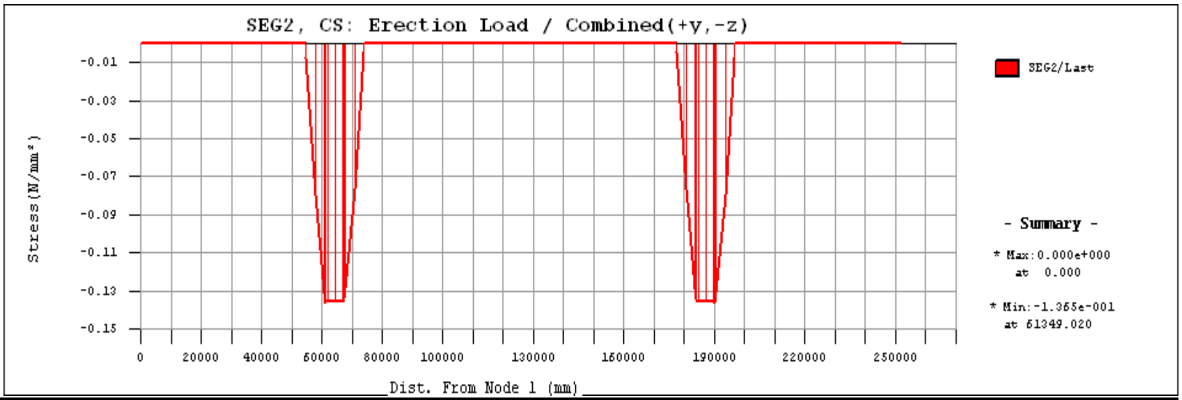

PS+SEG1, CS: Shrinkage Primary / Combined(+y,-z)
PS+SEG1/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-3.735e-001
at 57846.222

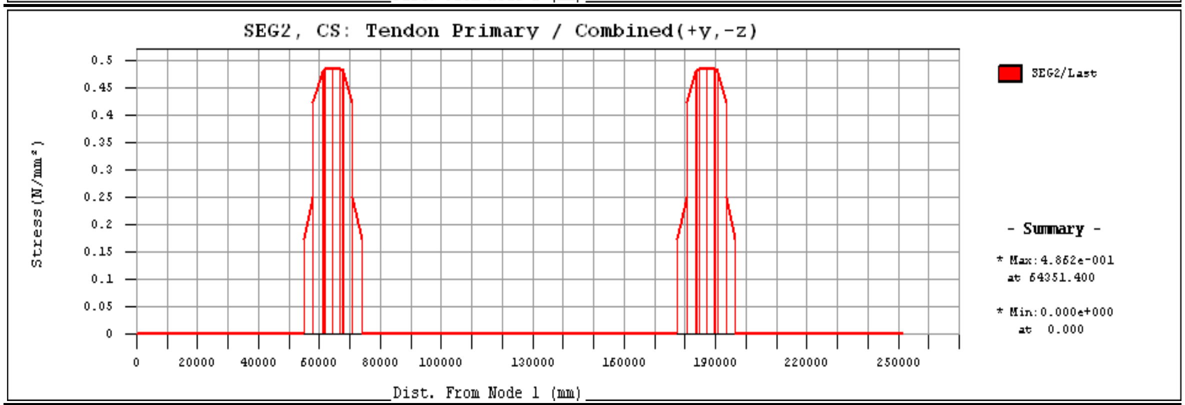

PS+SEG1, CS: Shrinkage Secondary / Combined(+y,-z)
PS+SEG1/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:1.484e-003
at 61349.020
* Min:-4.200e-005
at 57846.222

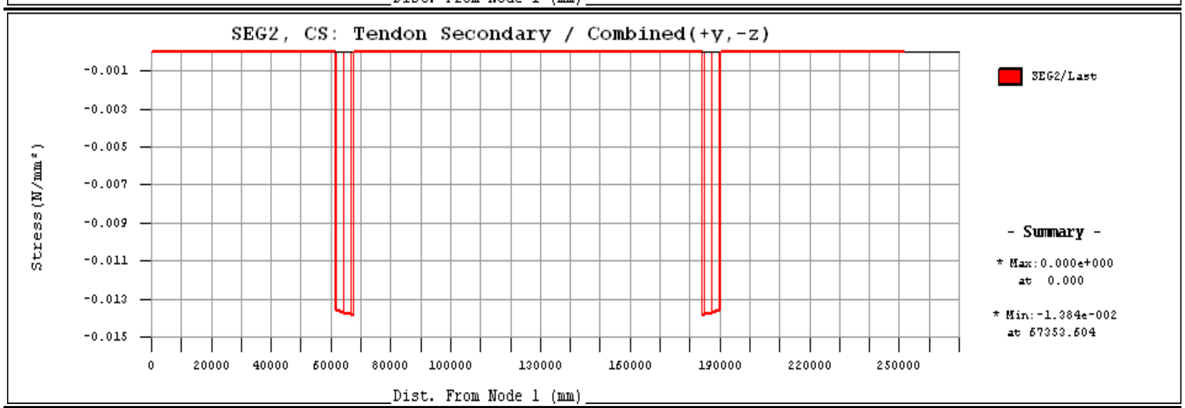

PS+SEG1, CS: Summation / Combined(+y,-z)
PS+SEG1/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:1.166e-001
at 180603.614
* Min:-7.586e-002
at 67353.604

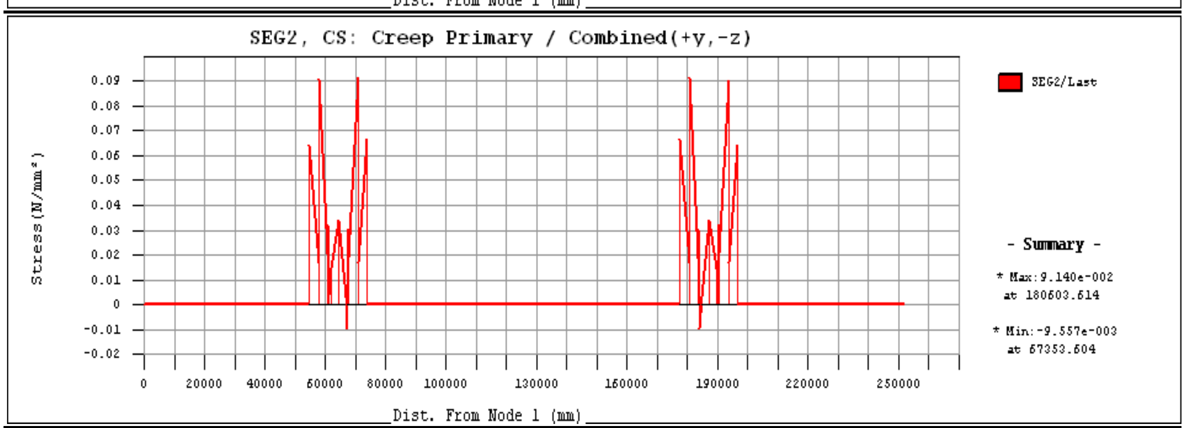
SEGMENT-2

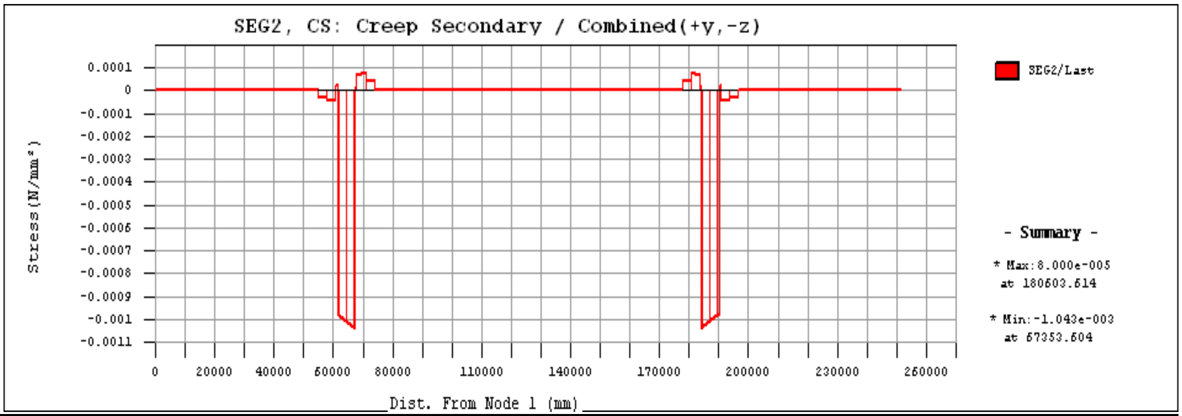

SEG2, CS: Dead Load / Combined(+y,-z)
SEG2/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-4.563e-001
at 67353.604

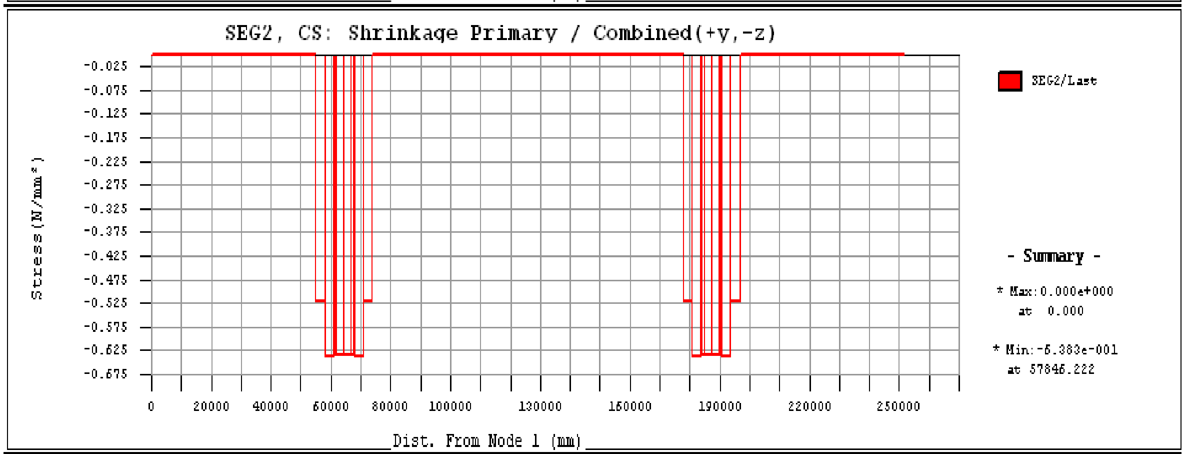

SEG2, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:0.000e+000 at 0.000
* Min:-1.365e-001 at 61349.020

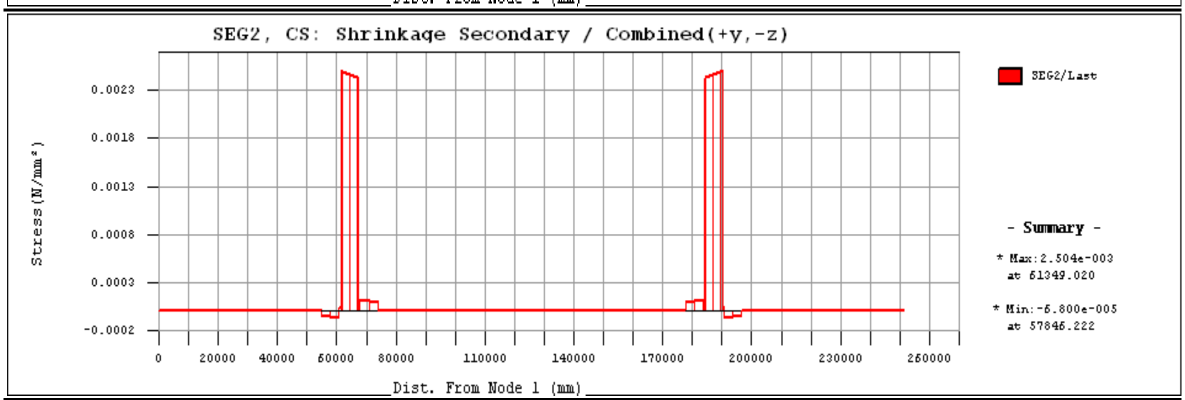

SEG2, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:4.862e-001 at 64351.400
* Min:0.000e+000 at 0.000

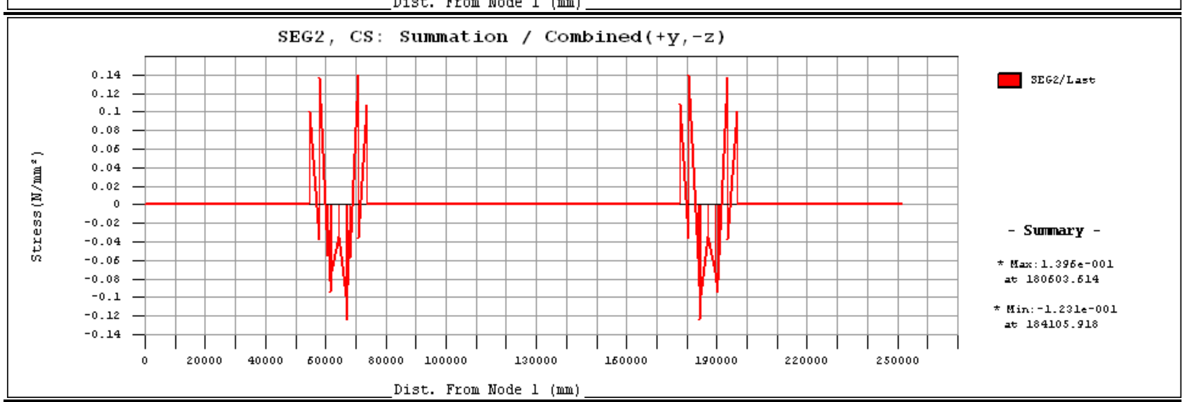

SEG2, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:0.000e+000 at 0.000
* Min:-1.384e-002 at 67353.604


SEG2, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:9.140e-002 at 180603.614
* Min:-9.557e-003 at 67353.604

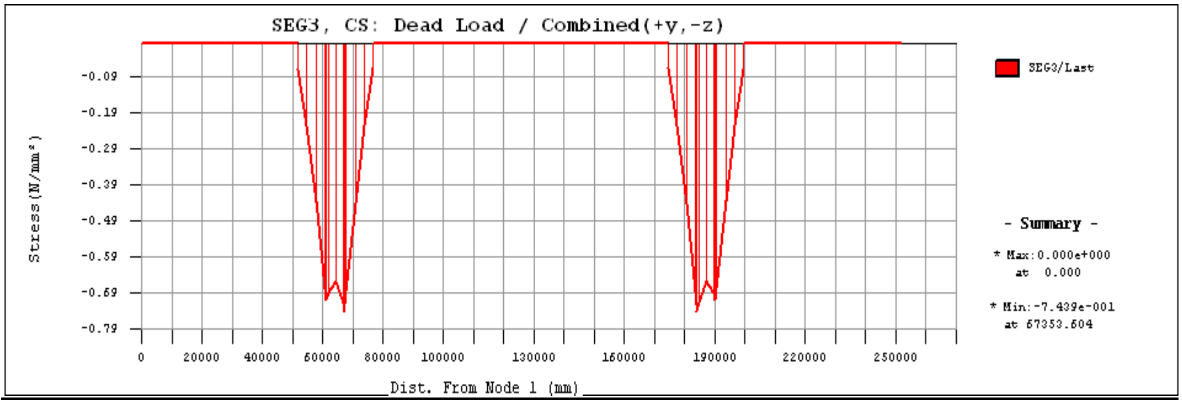

SEG2, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:8.000e-005
at 180503.514
* Min:-1.043e-003
at 67353.504

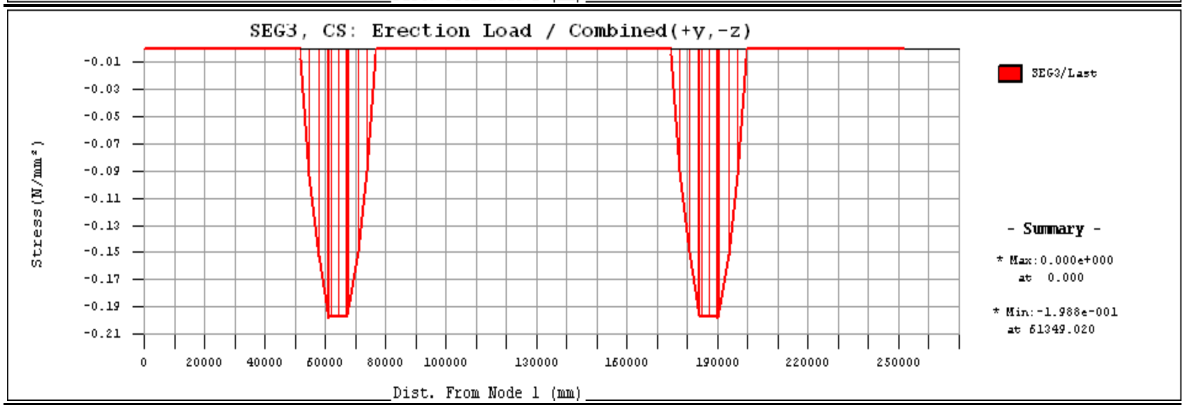

SEG2, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-6.383e-001
at 57846.222

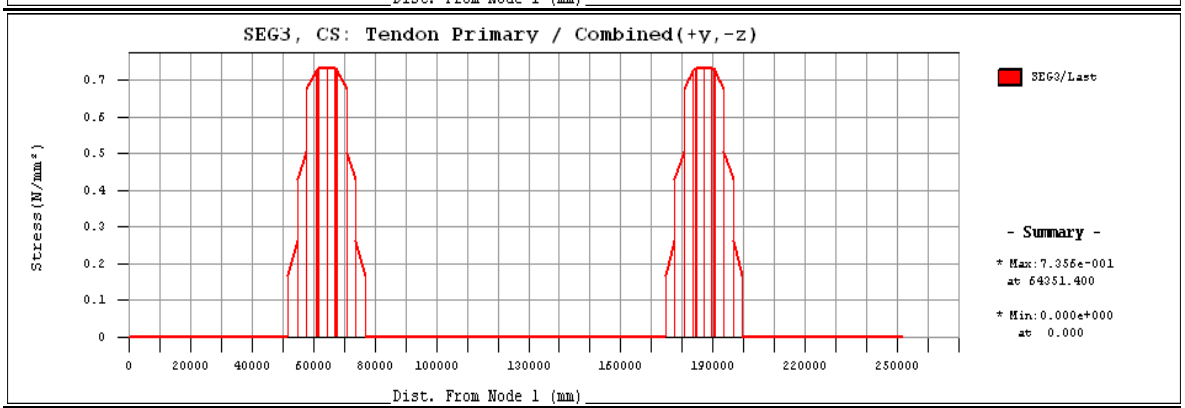

SEG2, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:2.504e-003
at 61349.020
* Min:-6.800e-005
at 57846.222

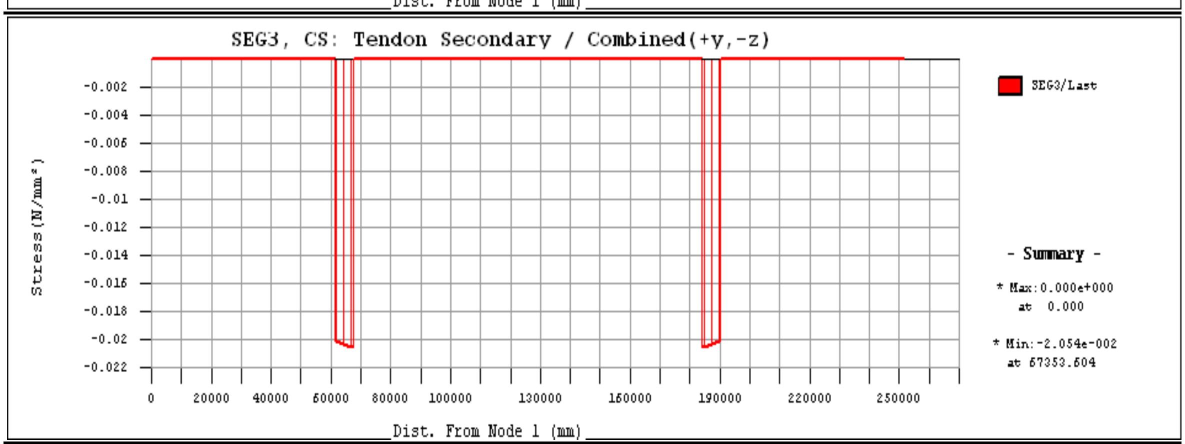

SEG2, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG2/Last
- Summary -
* Max:1.396e-001
at 180503.514
* Min:-1.231e-001
at 184105.918

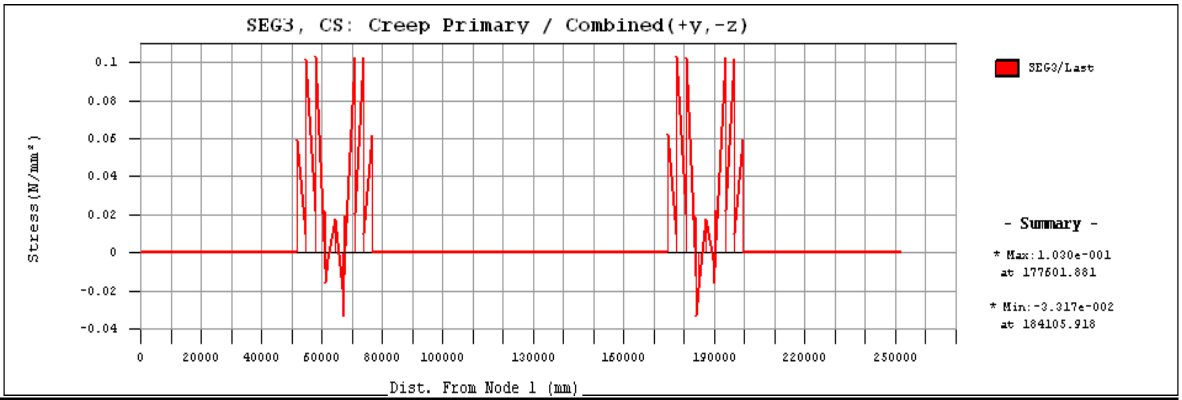
SEGMENT-3

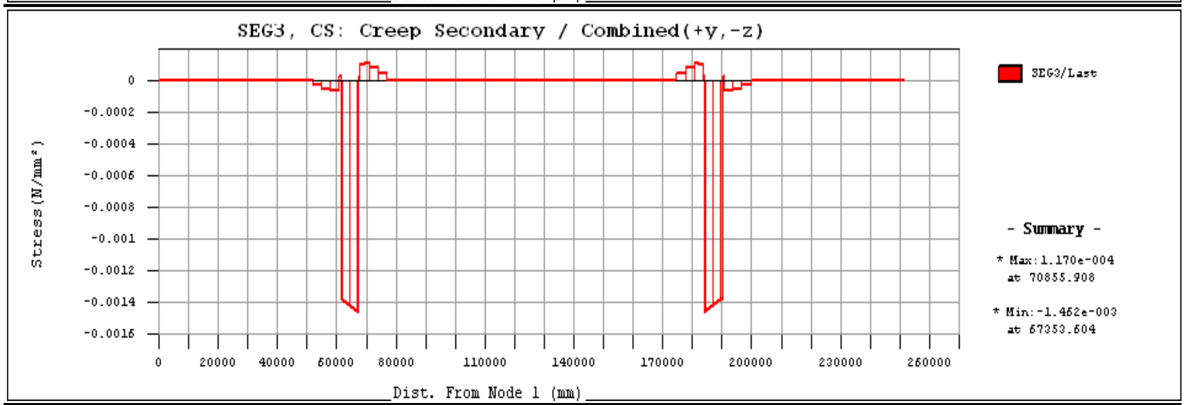

SEG3, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-7.439e-001
at 67353.604

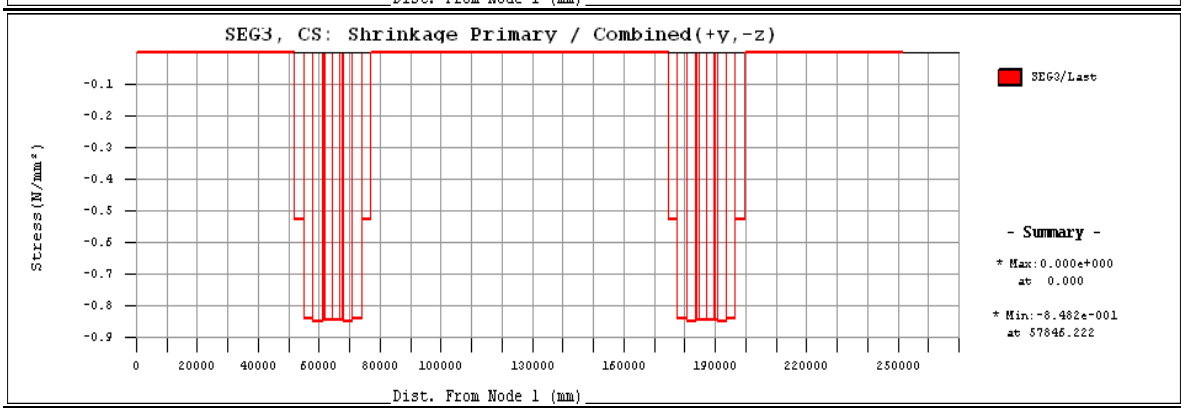

SEG3, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.988e-001
at 61349.020

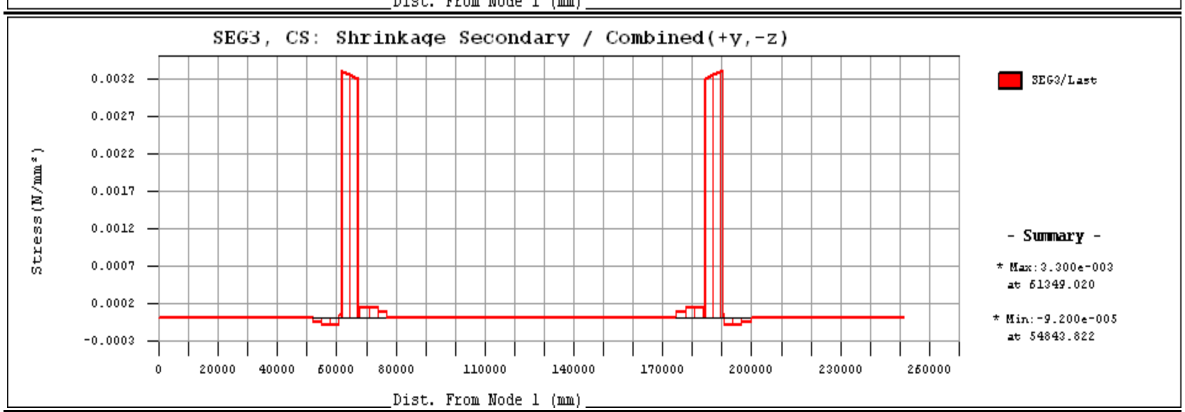

SEG3, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:7.356e-001
at 64351.400
* Min:0.000e+000
at 0.000

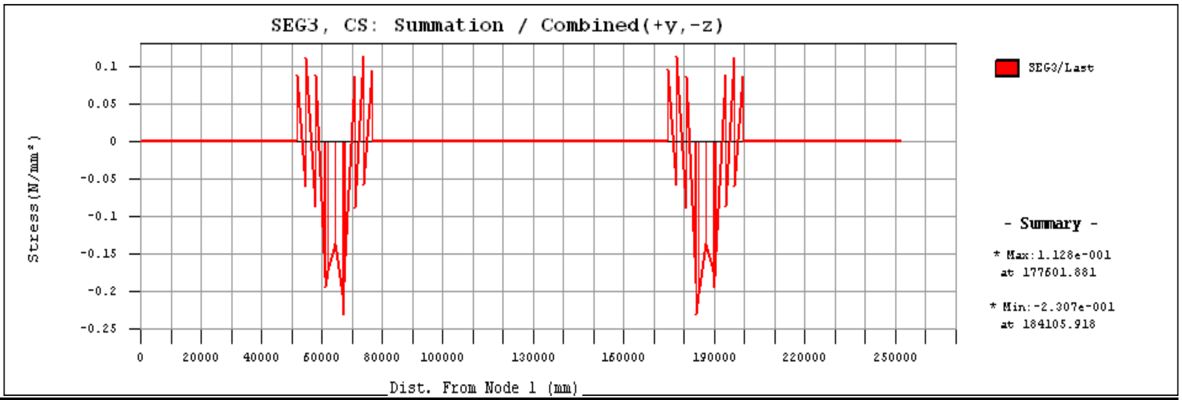

SEG3, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG3/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.054e-002
at 67353.604


SEG3, CS: Creep Primary / Combined(+y,-z)
SEG3/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:1.030e-001
at 177501.881
* Min:-3.317e-002
at 184105.918

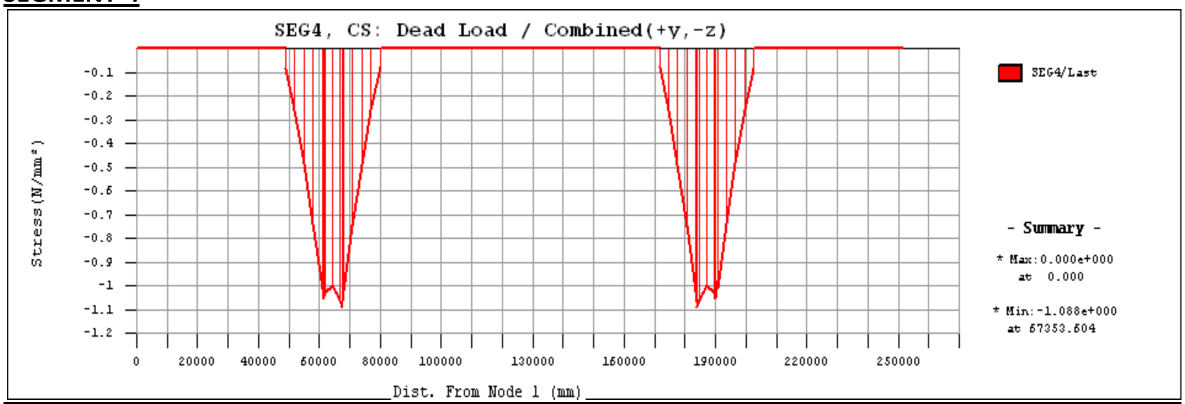

SEG3, CS: Creep Secondary / Combined(+y,-z)
SEG3/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:1.170e-004
at 70855.908
* Min:-1.462e-003
at 67353.504

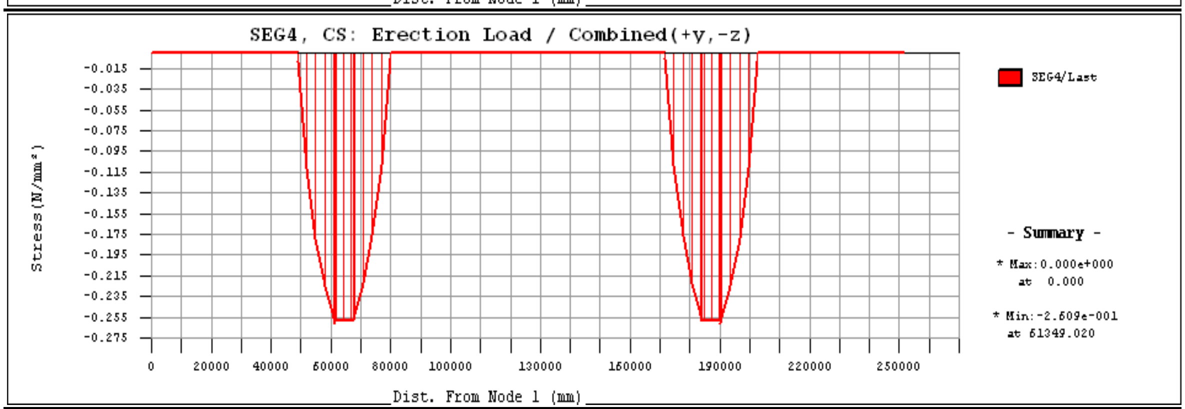

SEG3, CS: Shrinkage Primary / Combined(+y,-z)
SEG3/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-8.482e-001
at 57846.222

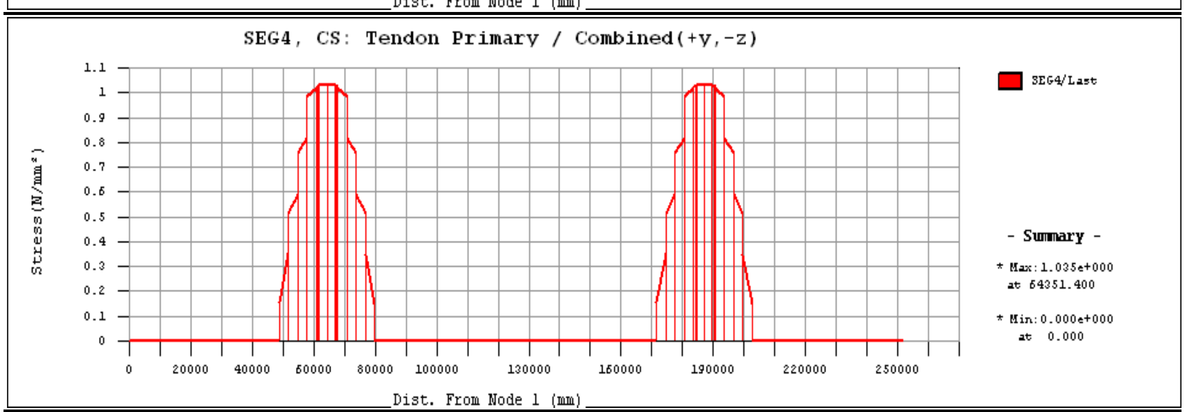

SEG3, CS: Shrinkage Secondary / Combined(+y,-z)
SEG3/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:3.300e-003
at 61349.020
* Min:-9.200e-005
at 54843.822

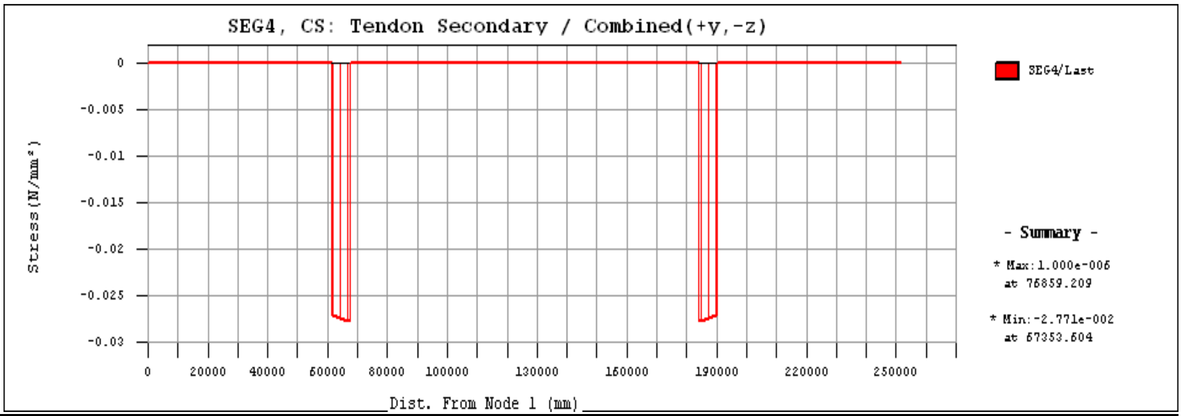

SEG3, CS: Summation / Combined(+y,-z)
SEG3/Last
- Summary -
* Max: 1.128e-001
at 177601.881
* Min: -2.307e-001
at 184105.918
Stress(N/mm²)
Dist. From Node 1 (mm)

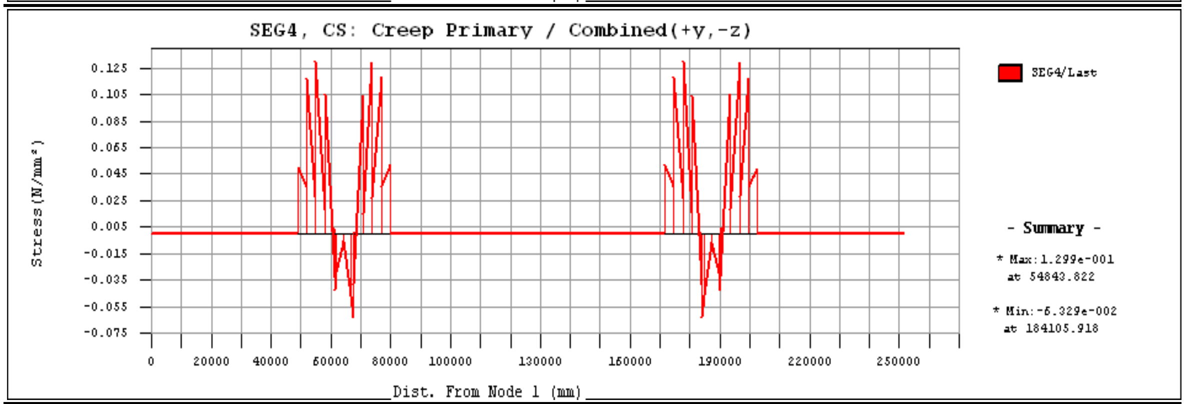
SEGMENT-4

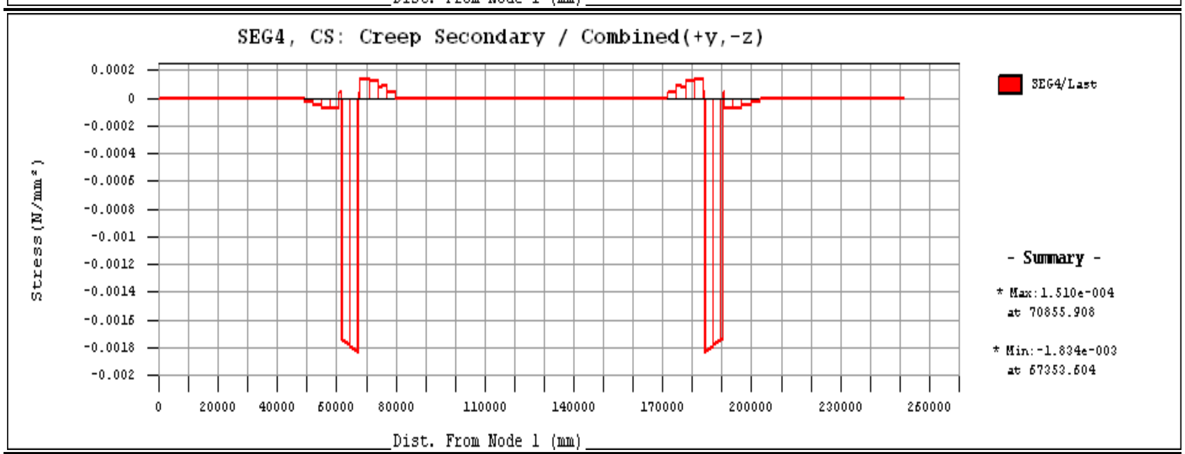

SEG4, CS: Dead Load / Combined(+y,-z)
SEG4/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -1.088e+000
at 67353.604
Stress(N/mm²)
Dist. From Node 1 (mm)

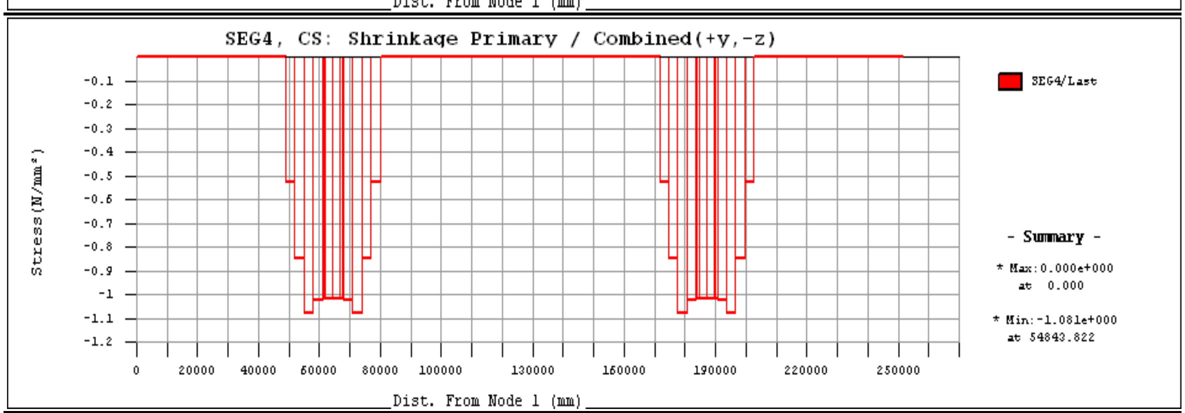

SEG4, CS: Erection Load / Combined(+y,-z)
SEG4/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -2.609e-001
at 61349.020
Stress(N/mm²)
Dist. From Node 1 (mm)

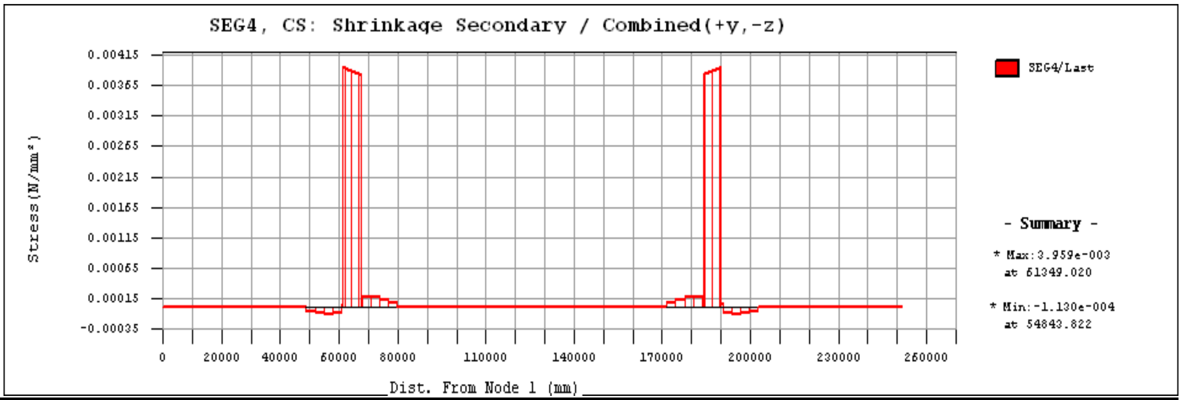

SEG4, CS: Tendon Primary / Combined(+y,-z)
SEG4/Last
- Summary -
* Max: 1.035e+000
at 64351.400
* Min: 0.000e+000
at 0.000
Stress(N/mm²)
Dist. From Node 1 (mm)

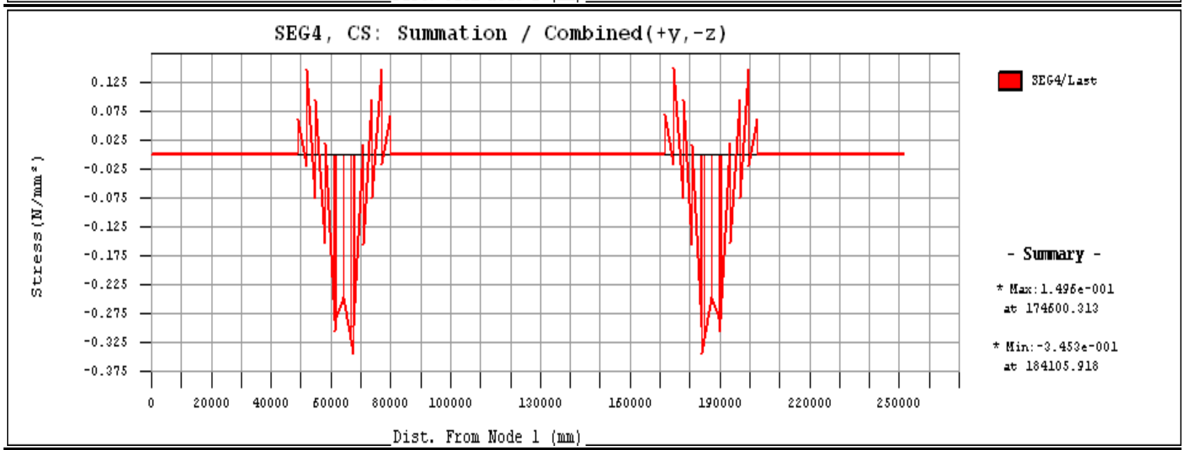

SEG4, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max:1.000e-006
at 76859.209
* Min:-2.771e-002
at 67353.604


SEG4, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max:1.299e-001
at 54843.822
* Min:-6.329e-002
at 184105.918

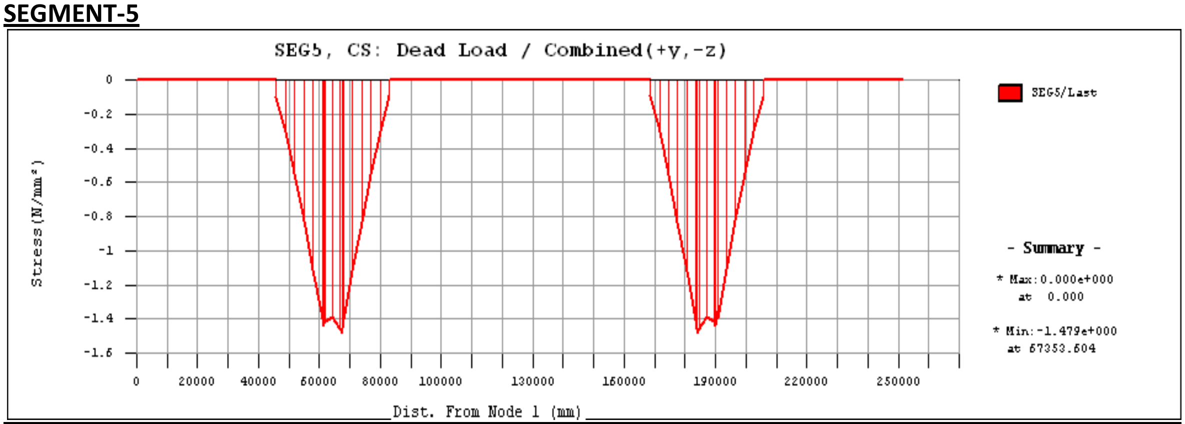

SEG4, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max:1.510e-004
at 70855.908
* Min:-1.834e-003
at 67353.604

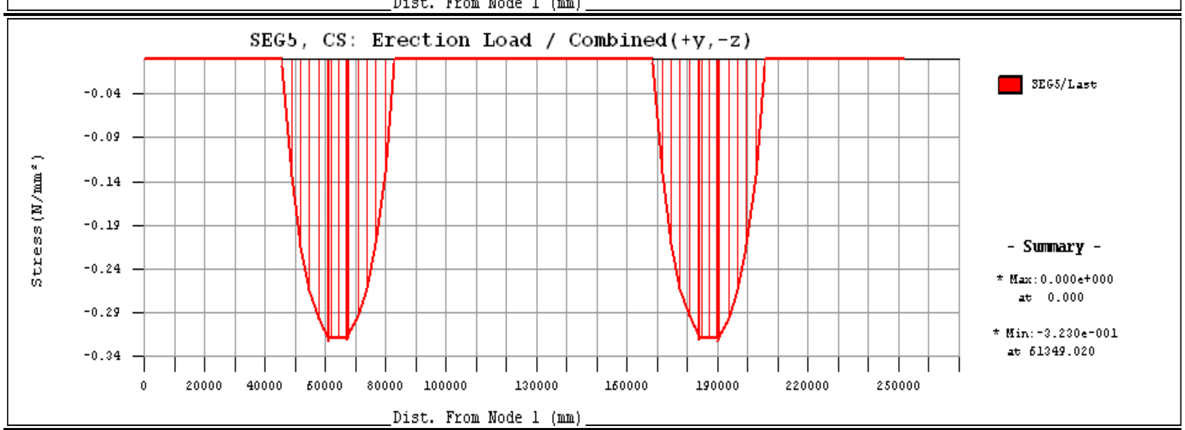

SEG4, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG4/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.081e+000
at 54843.822

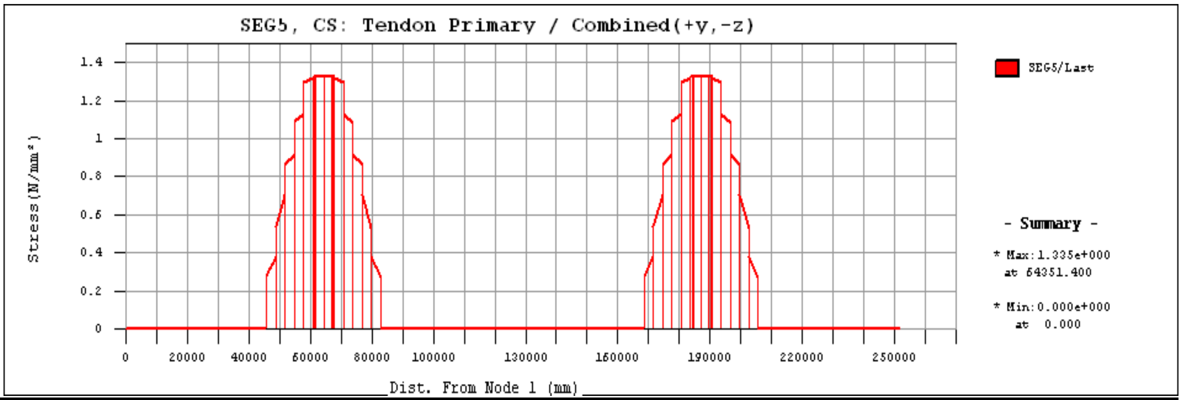

SEG4, CS: Shrinkage Secondary / Combined(+y,-z)
SEG4/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:3.959e-003
at 61349.020
* Min:-1.130e-004
at 54843.822

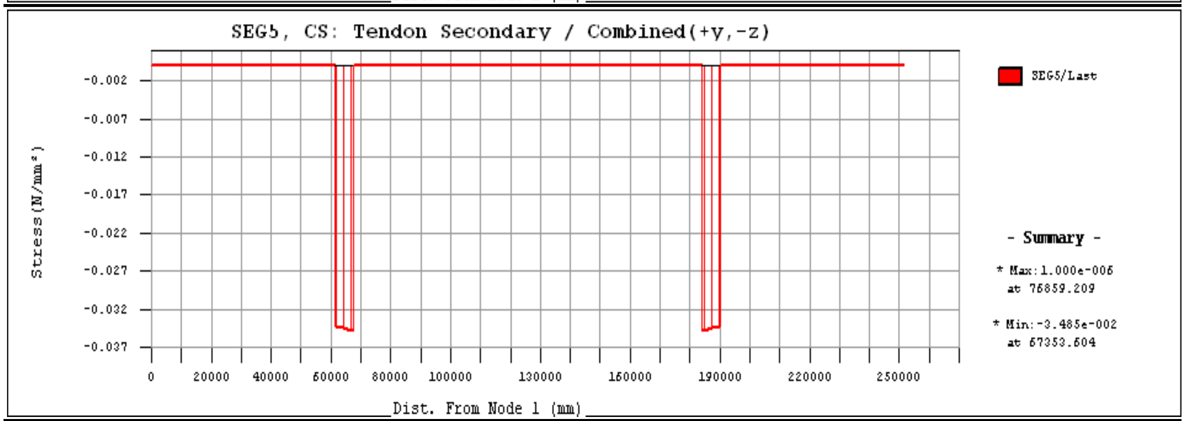

SEG4, CS: Summation / Combined(+y,-z)
SEG4/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:1.496e-001
at 174600.313
* Min:-3.453e-001
at 184105.918

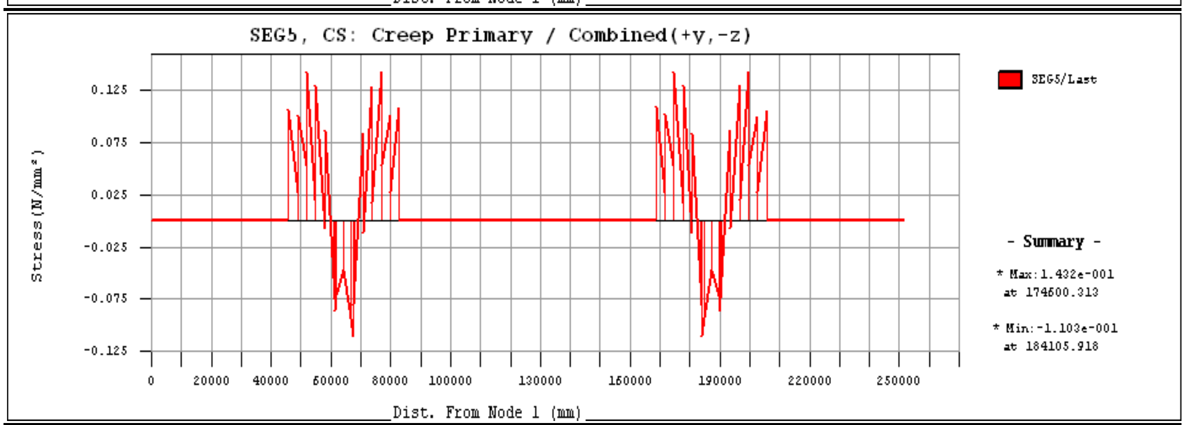
SEGMENT-5

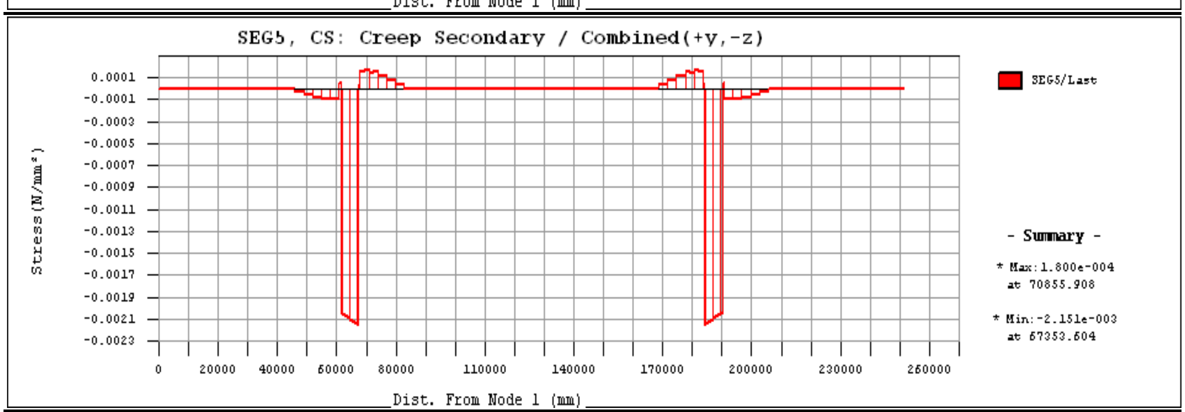

SEG5, CS: Dead Load / Combined(+y,-z)
SEG5/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.479e+000
at 67353.604

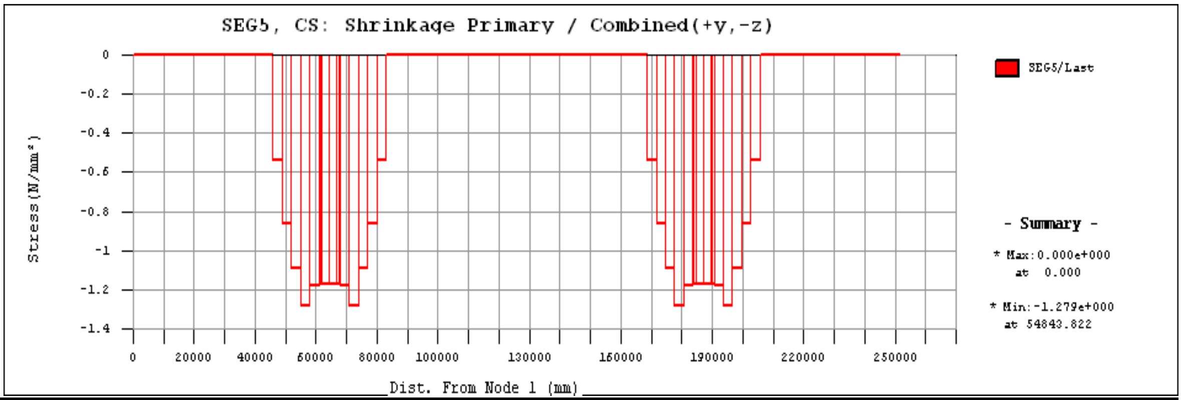

SEG5, CS: Erection Load / Combined(+y,-z)
SEG5/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max:0.000e+000
at 0.000
* Min:-3.230e-001
at 61349.020

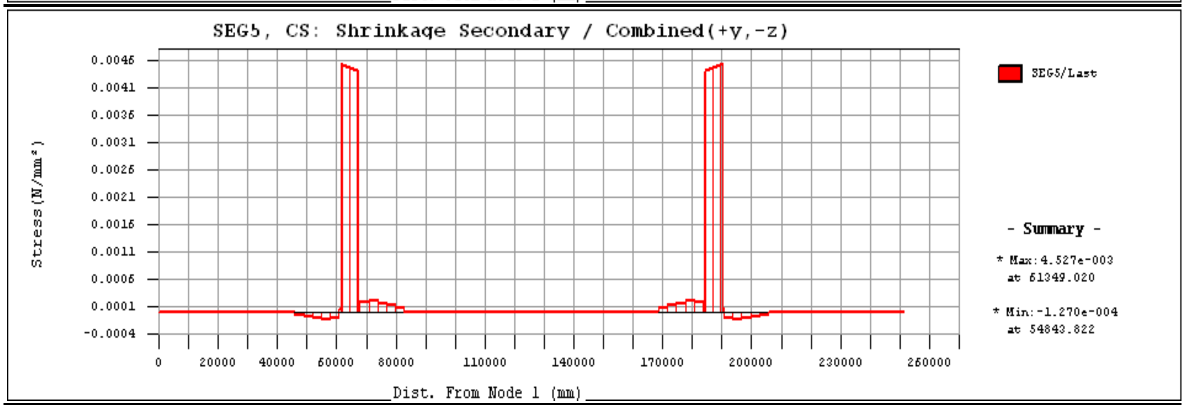

SEG5, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0 20000 40000 60000 80000 100000 130000 160000 190000 220000 250000
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:1.335e+000 at 64351.400
* Min:0.000e+000 at 0.000

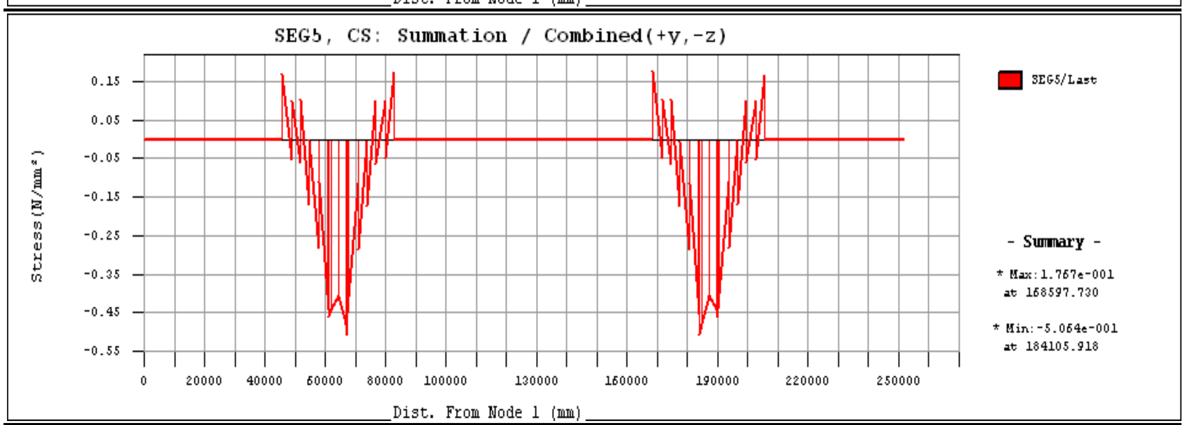

SEG5, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
-0.002
-0.007
-0.012
-0.017
-0.022
-0.027
-0.032
-0.037
0 20000 40000 60000 80000 100000 130000 160000 190000 220000 250000
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:1.000e-006 at 76859.209
* Min:-3.485e-002 at 67353.604


SEG5, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
0.125
0.075
0.025
-0.025
-0.075
-0.125
0 20000 40000 60000 80000 100000 130000 160000 190000 220000 250000
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:1.432e-001 at 174600.313
* Min:-1.103e-001 at 184105.918

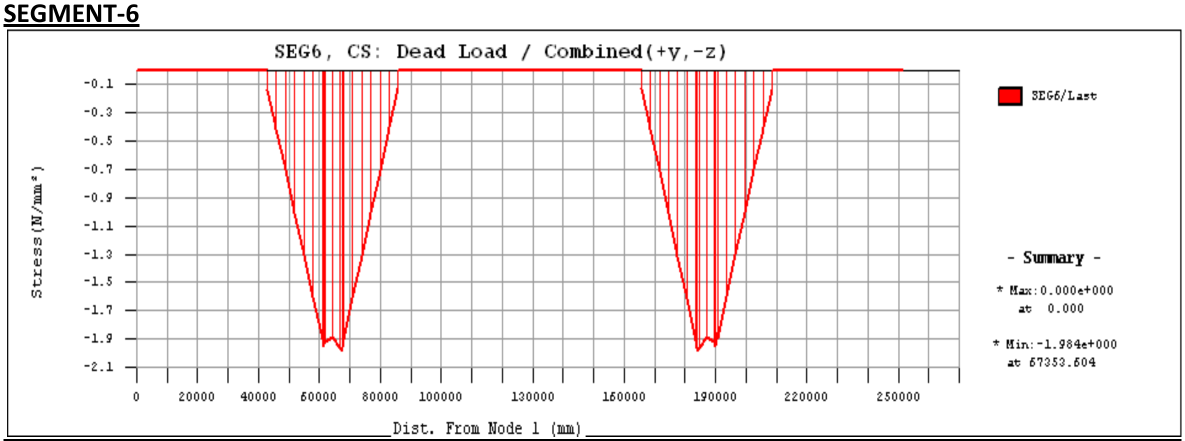

SEG5, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
0.0001
-0.0001
-0.0003
-0.0005
-0.0007
-0.0009
-0.0011
-0.0013
-0.0015
-0.0017
-0.0019
-0.0021
-0.0023
0 20000 40000 60000 80000 110000 140000 170000 200000 230000 260000
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:1.800e-004 at 70855.908
* Min:-2.151e-003 at 67353.604

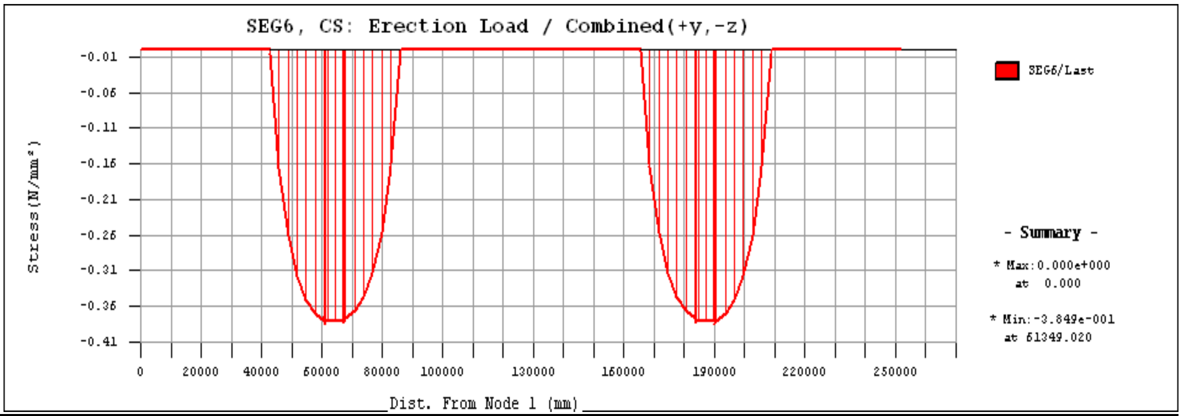

SEG5, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:0.000e+000 at 0.000
* Min:-1.279e+000 at 54843.822

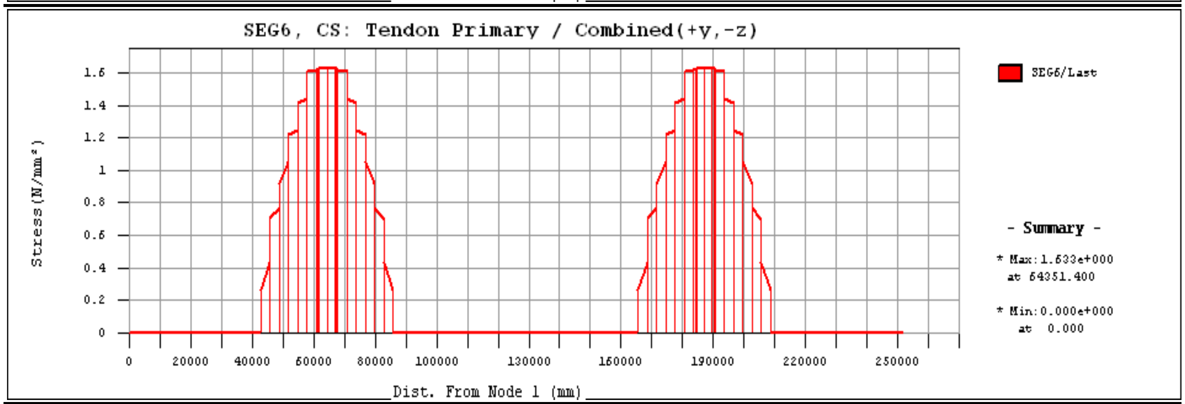

SEG5, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:4.527e-003 at 61349.020
* Min:-1.270e-004 at 54843.822

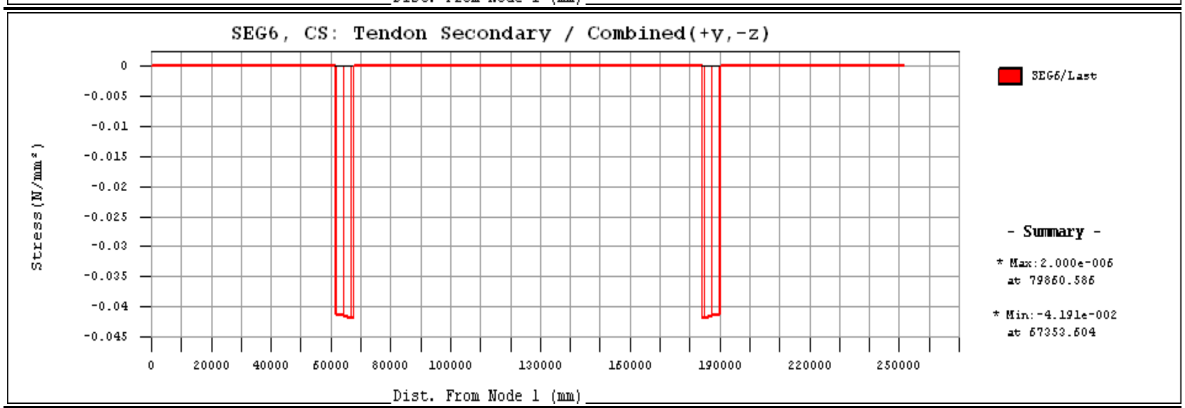

SEG5, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG5/Last
- Summary -
* Max:1.757e-001 at 158597.730
* Min:-5.064e-001 at 184105.918

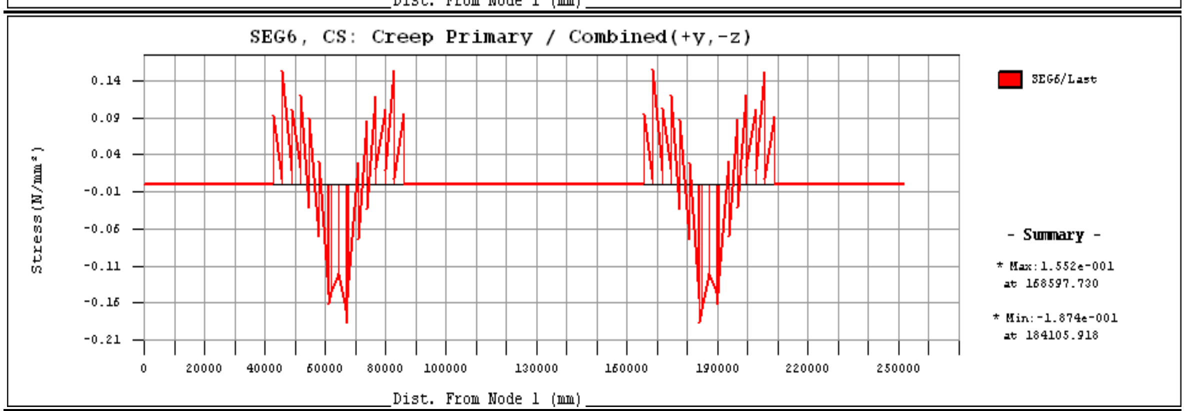
SEGMENT-6

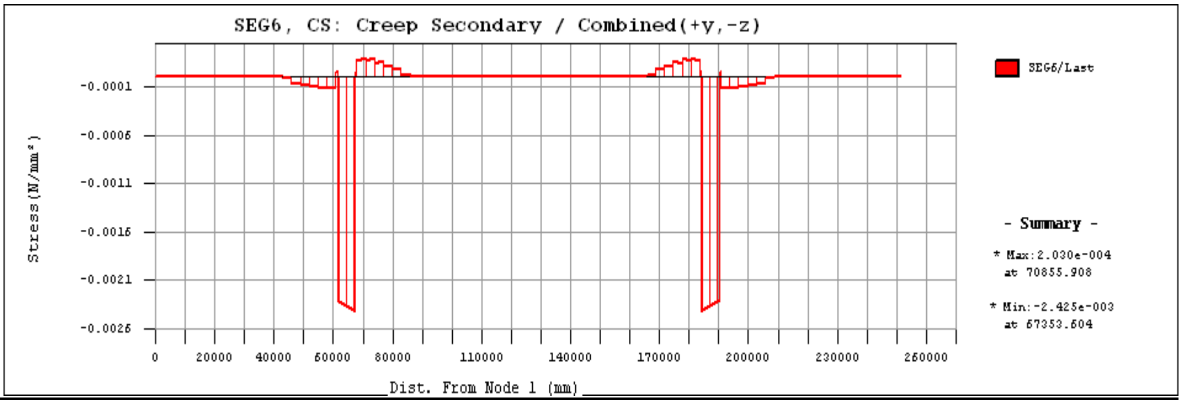

SEG6, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max:0.000e+000 at 0.000
* Min:-1.984e+000 at 67353.504

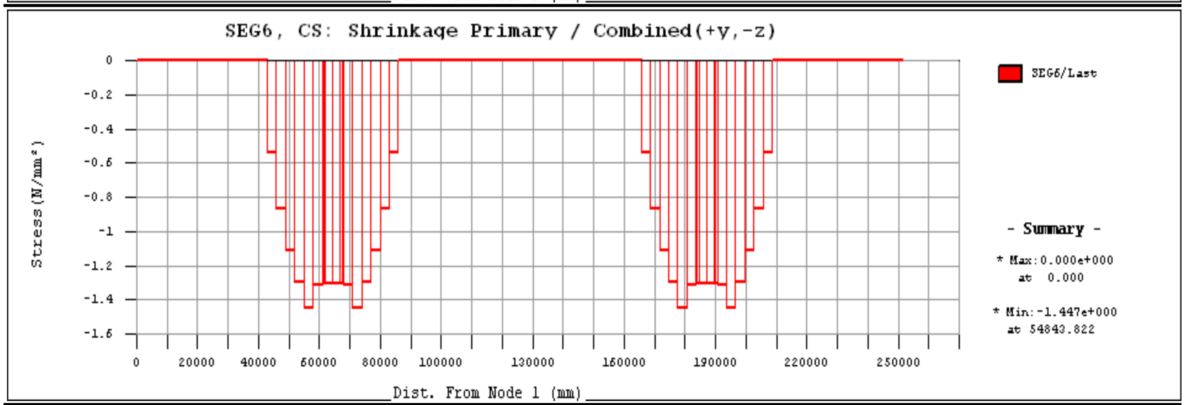

SEG6, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-3.849e-001
at 61349.020

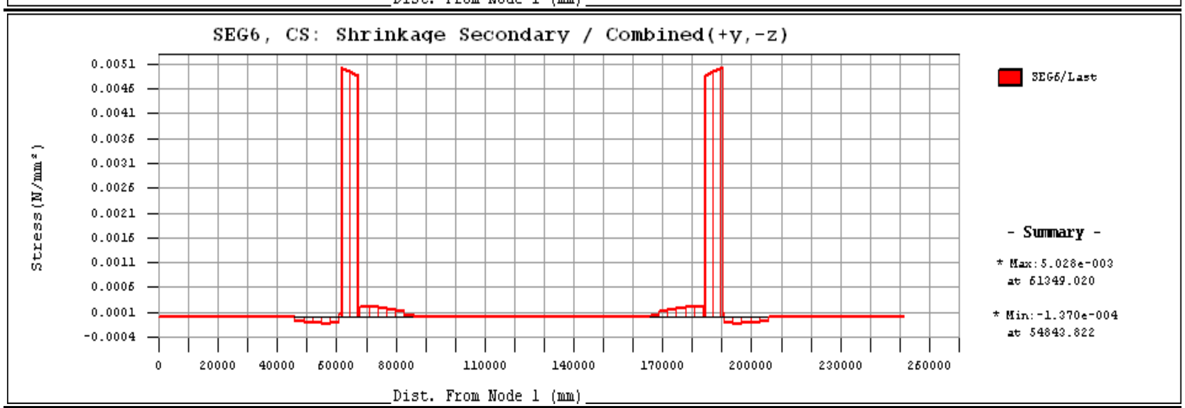

SEG6, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max:1.633e+000
at 64351.400
* Min:0.000e+000
at 0.000

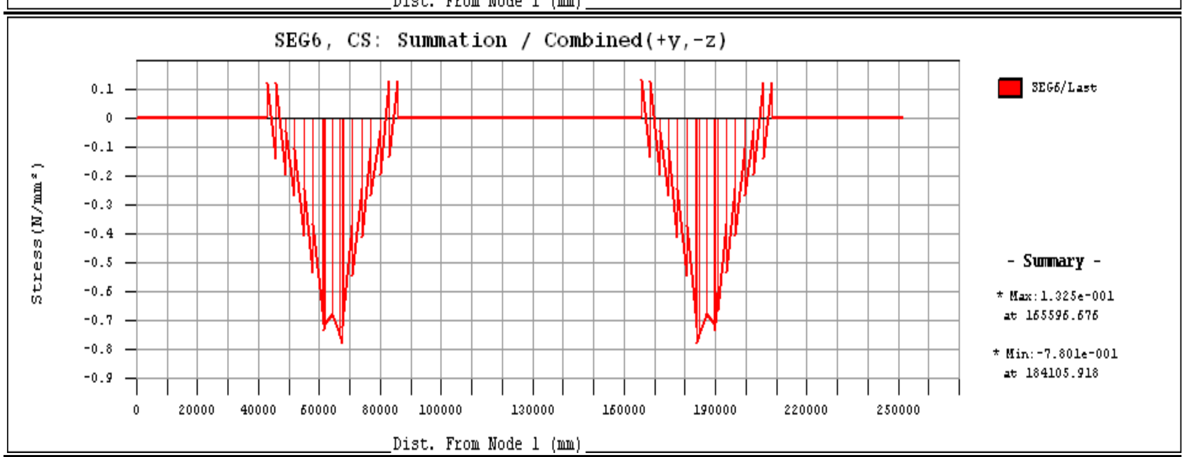

SEG6, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max:2.000e-006
at 79860.586
* Min:-4.191e-002
at 67353.604


SEG6, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max:1.552e-001
at 168597.730
* Min:-1.874e-001
at 184105.918

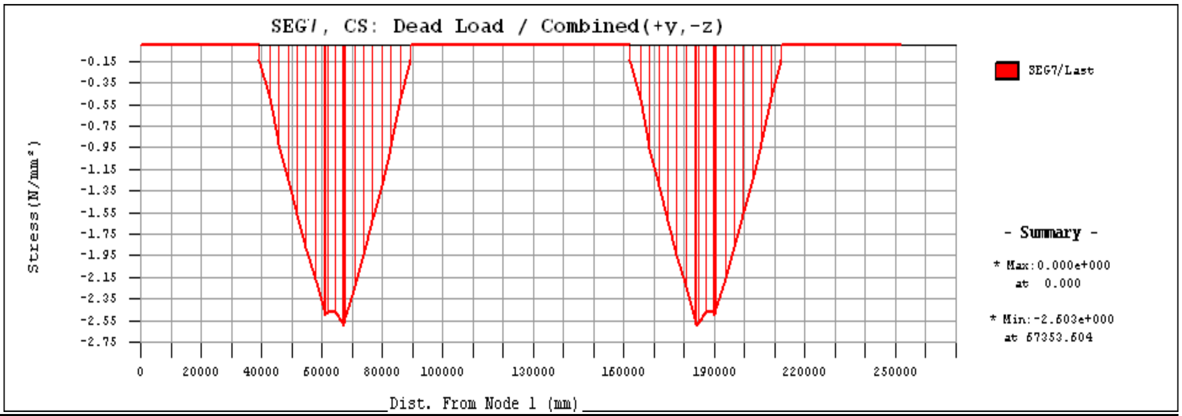

SEG6, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
-0.0001
-0.0006
-0.0011
-0.0016
-0.0021
-0.0026
0
20000
40000
60000
80000
110000
140000
170000
200000
230000
260000
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max:2.030e-004
at 70855.908
* Min:-2.425e-003
at 67353.604

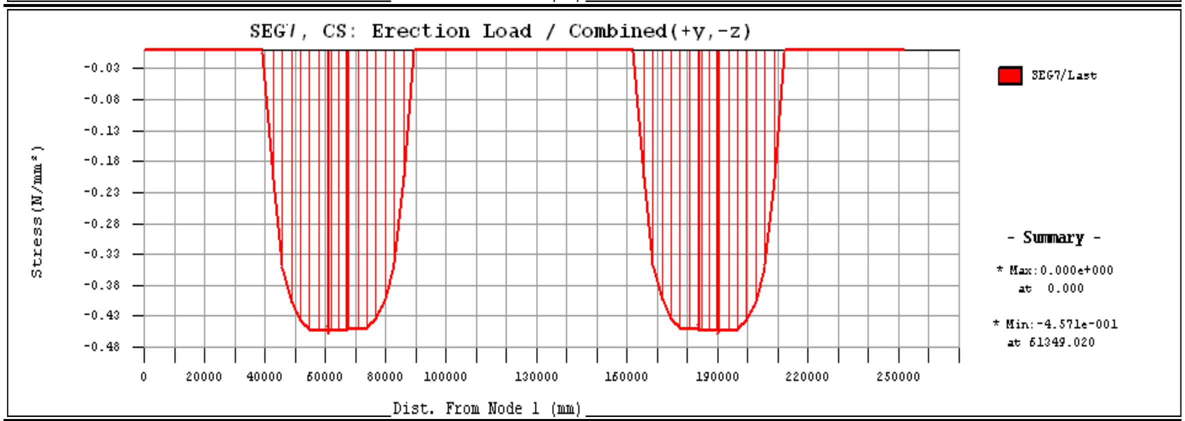

SEG6, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
0
20000
40000
60000
80000
100000
130000
160000
190000
220000
250000
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.447e+000
at 54843.822

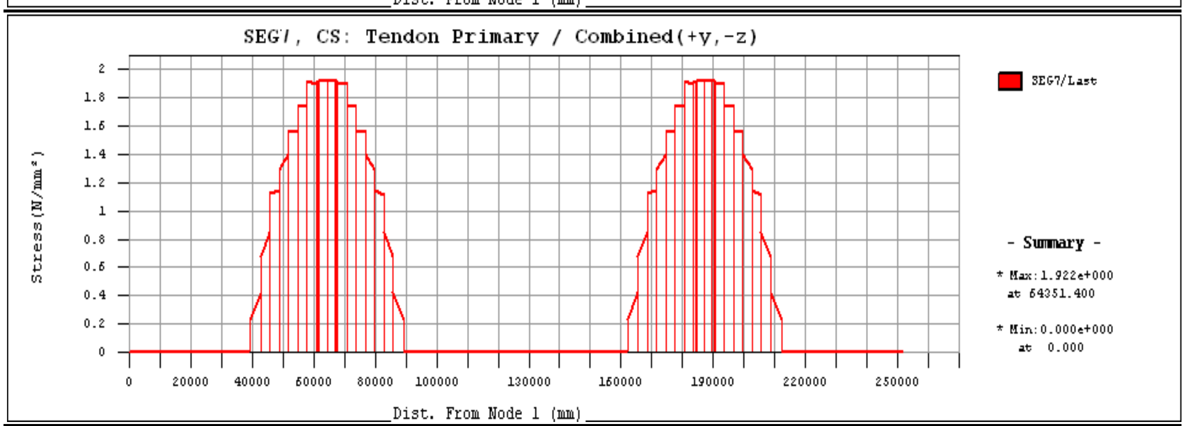

SEG6, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
0.0051
0.0046
0.0041
0.0036
0.0031
0.0026
0.0021
0.0016
0.0011
0.0006
0.0001
-0.0004
0
20000
40000
60000
80000
110000
140000
170000
200000
230000
260000
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max:5.028e-003
at 61349.020
* Min:-1.370e-004
at 54843.822

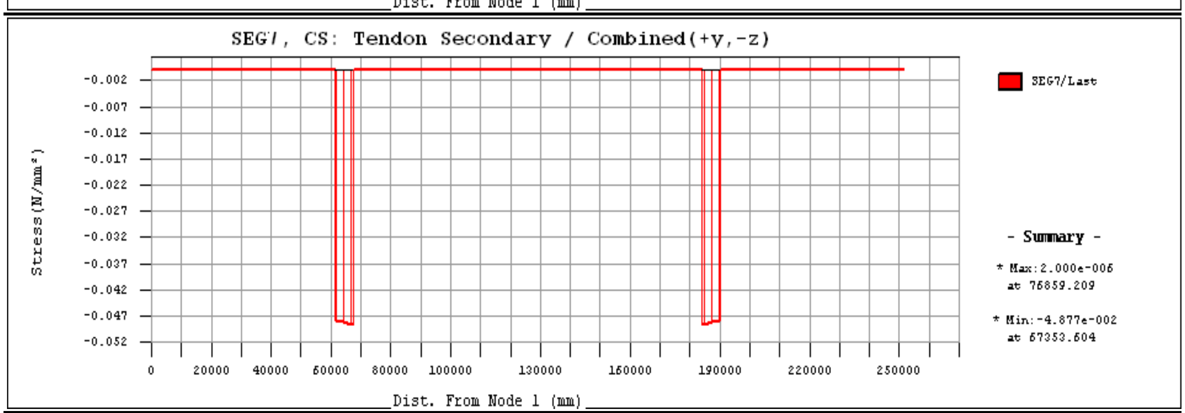

SEG6, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
0
20000
40000
60000
80000
100000
130000
160000
190000
220000
250000
Dist. From Node 1 (mm)
SEG6/Last
- Summary -
* Max:1.325e-001
at 165595.676
* Min:-7.801e-001
at 184105.918

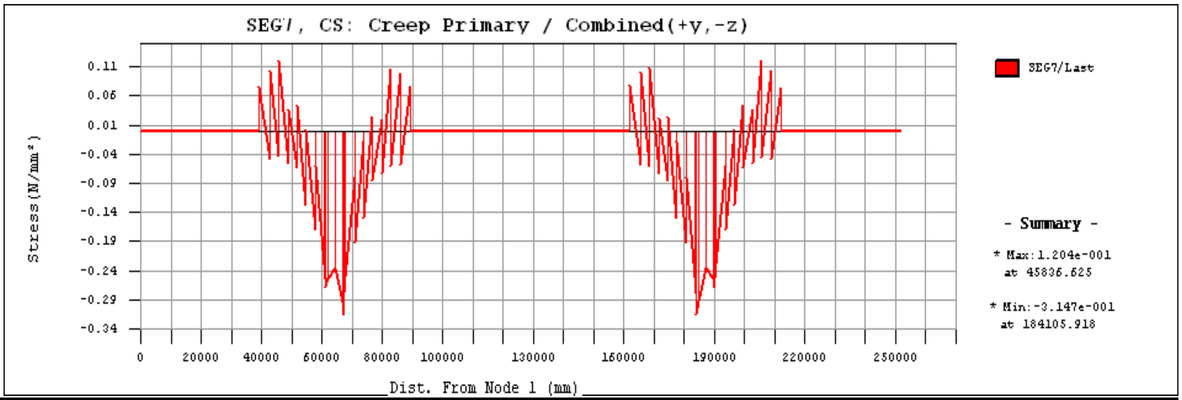
SEGMENT-7

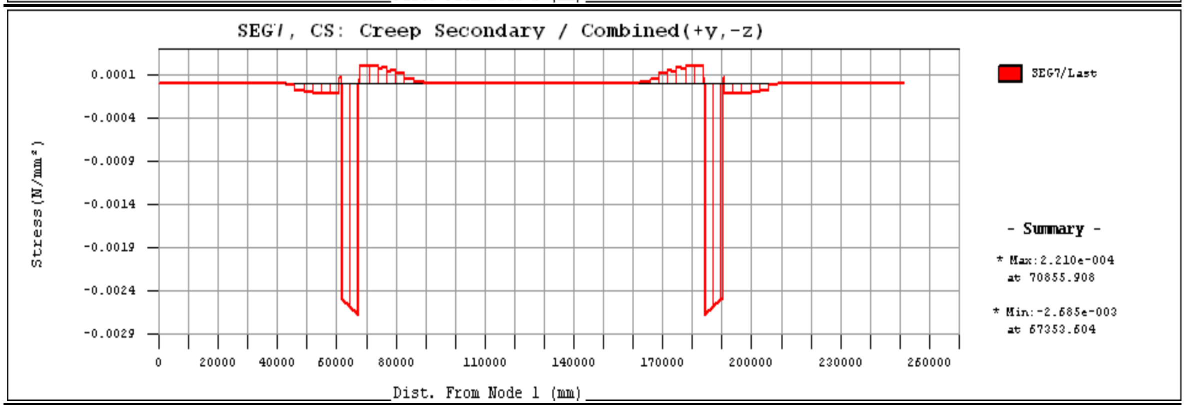

SEG7, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.603e+000
at 67353.604

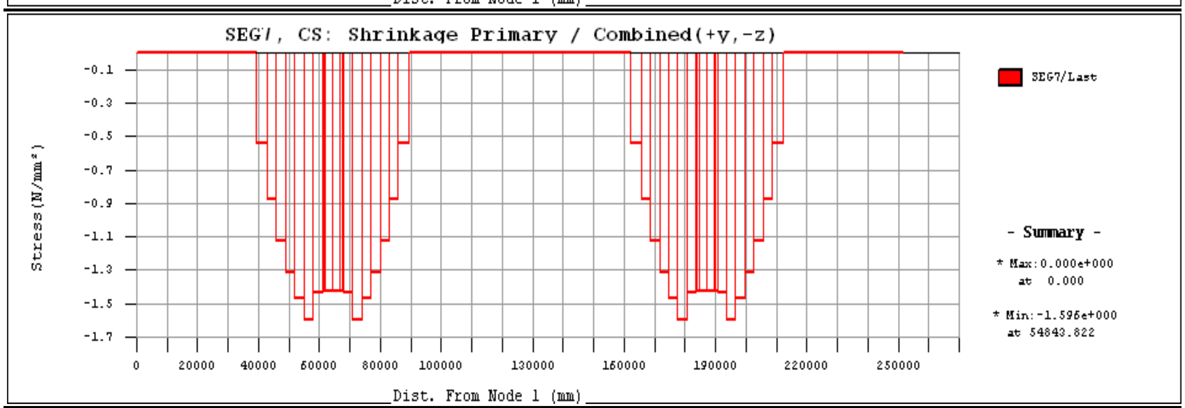

SEG7, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-4.571e-001
at 61349.020

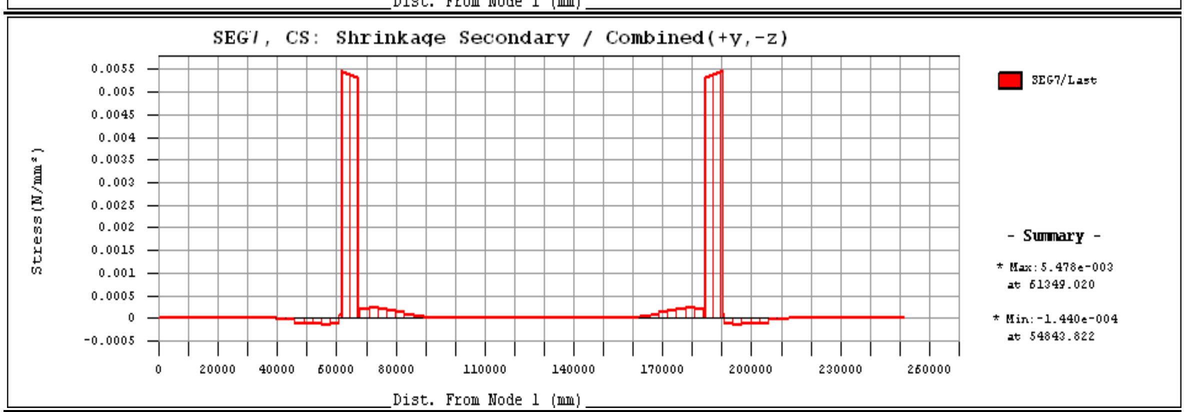

SEG7, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:1.922e+000
at 64351.400
* Min:0.000e+000
at 0.000

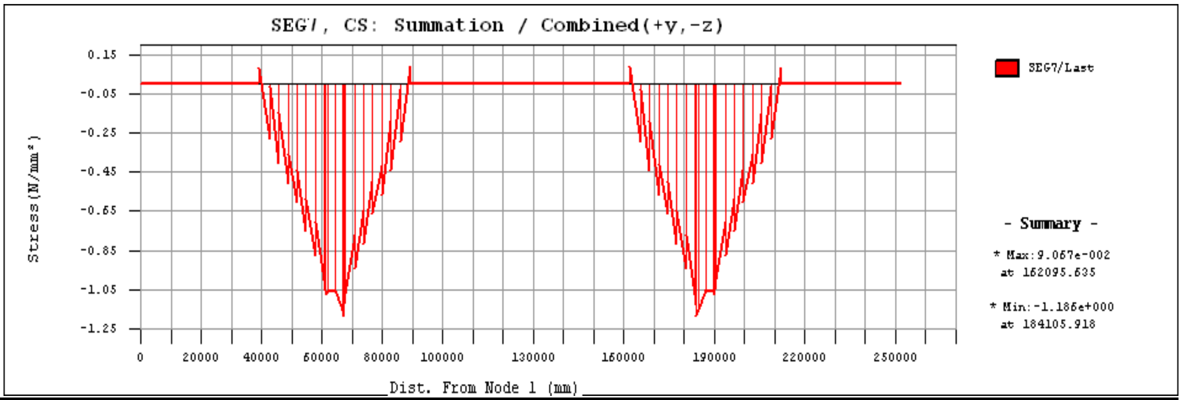

SEG7, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:2.000e-006
at 76859.209
* Min:-4.877e-002
at 67353.604


SEG7, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
0.11
0.06
0.01
-0.04
-0.09
-0.14
-0.19
-0.24
-0.29
-0.34
0 20000 40000 60000 80000 100000 130000 160000 190000 220000 250000
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:1.204e-001
at 45836.625
* Min:-3.147e-001
at 184105.918

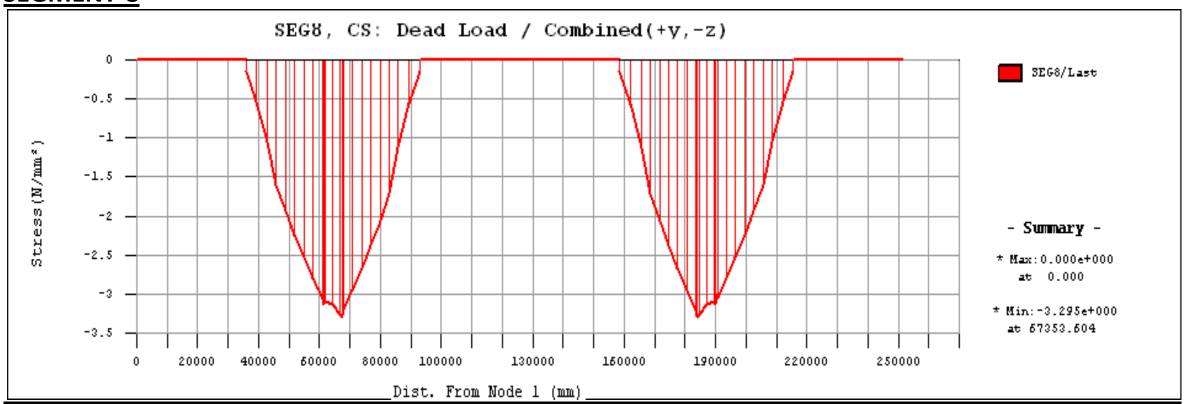

SEG7, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
0.0001
-0.0004
-0.0009
-0.0014
-0.0019
-0.0024
-0.0029
0 20000 40000 60000 80000 110000 140000 170000 200000 230000 260000
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:2.210e-004
at 70855.908
* Min:-2.685e-003
at 67353.604

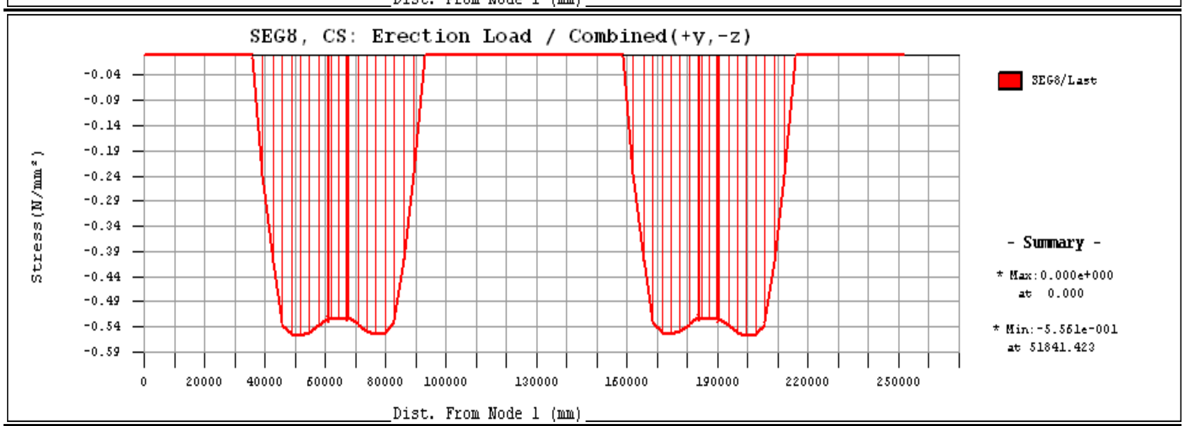

SEG7, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
-0.1
-0.3
-0.5
-0.7
-0.9
-1.1
-1.3
-1.5
-1.7
0 20000 40000 60000 80000 100000 130000 160000 190000 220000 250000
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.596e+000
at 54843.822

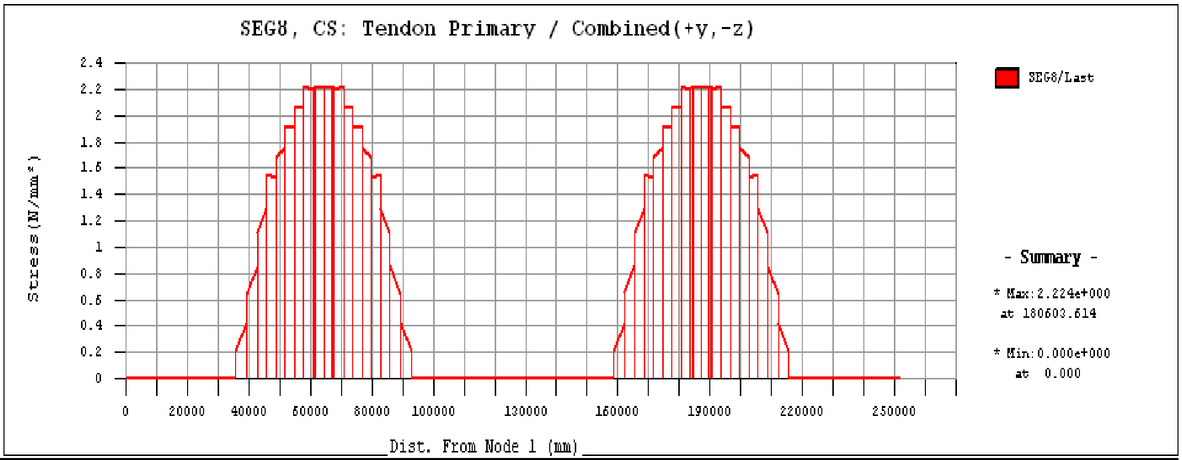

SEG7, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
0.0055
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
-0.0005
0 20000 40000 60000 80000 110000 140000 170000 200000 230000 260000
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max:5.478e-003
at 61349.020
* Min:-1.440e-004
at 54843.822

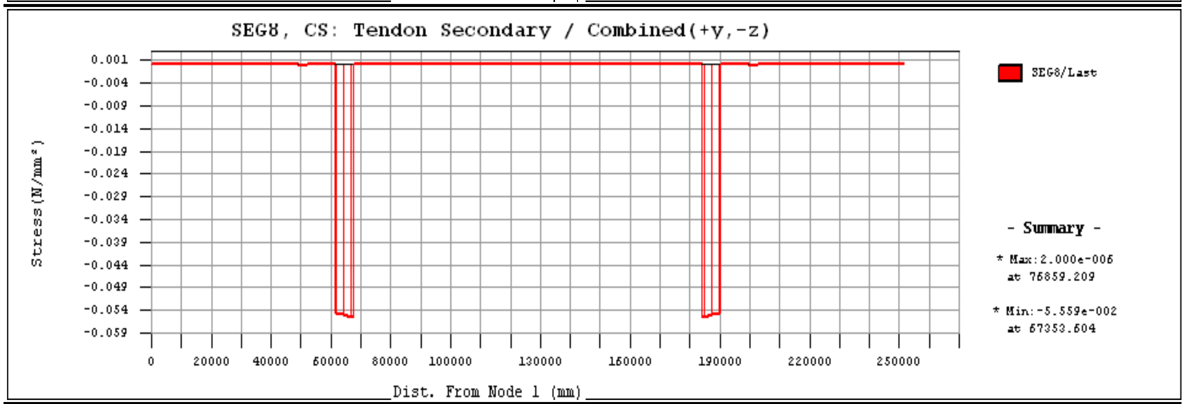

SEG7, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
0.15
-0.05
-0.25
-0.45
-0.65
-0.85
-1.05
-1.25
0
20000
40000
60000
80000
100000
130000
160000
190000
220000
250000
Dist. From Node 1 (mm)
SEG7/Last
- Summary -
* Max: 9.067e-002
at 162095.635
* Min: -1.186e+000
at 184105.918

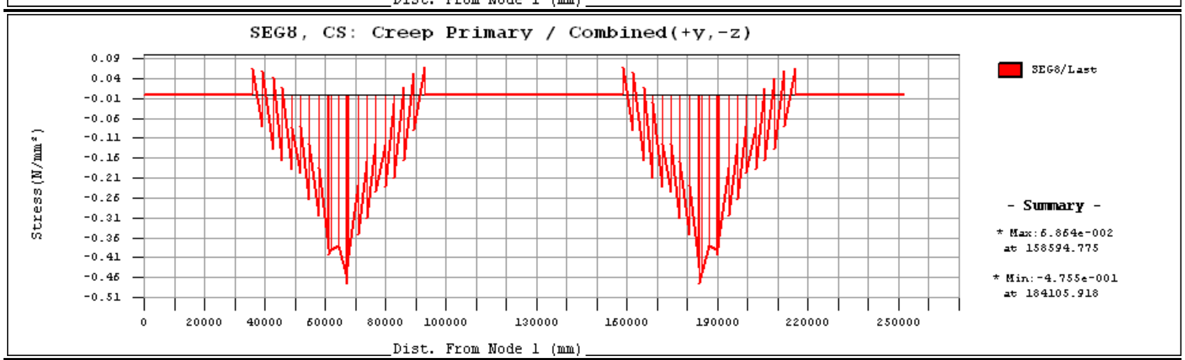
SEGMENT-8

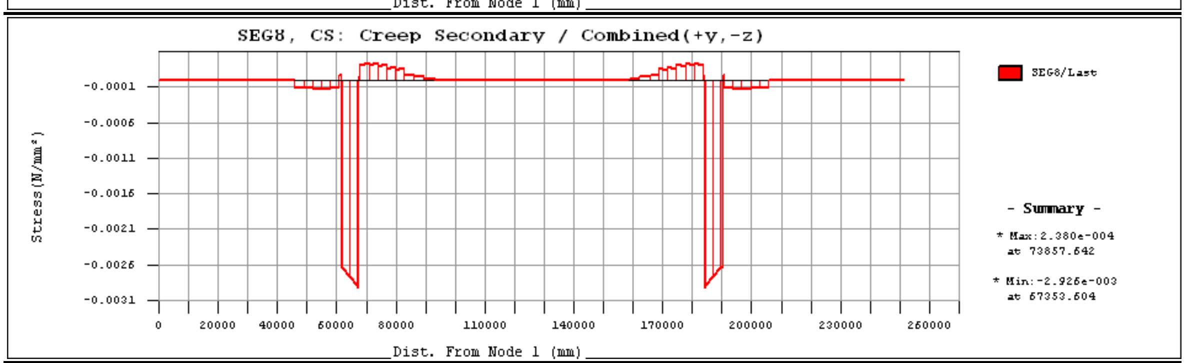

SEG8, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
0
20000
40000
60000
80000
100000
130000
160000
190000
220000
250000
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -3.295e+000
at 67353.604

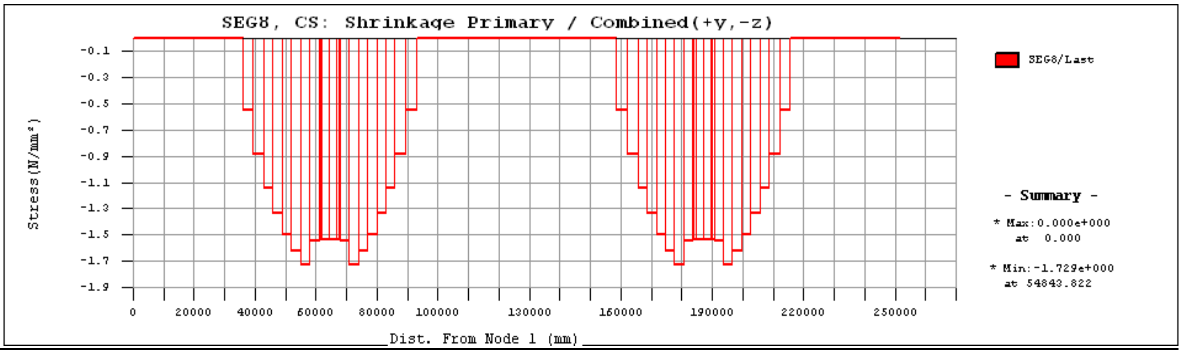

SEG8, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
-0.04
-0.09
-0.14
-0.19
-0.24
-0.29
-0.34
-0.39
-0.44
-0.49
-0.54
-0.59
0
20000
40000
60000
80000
100000
130000
160000
190000
220000
250000
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -5.561e-001
at 51841.423

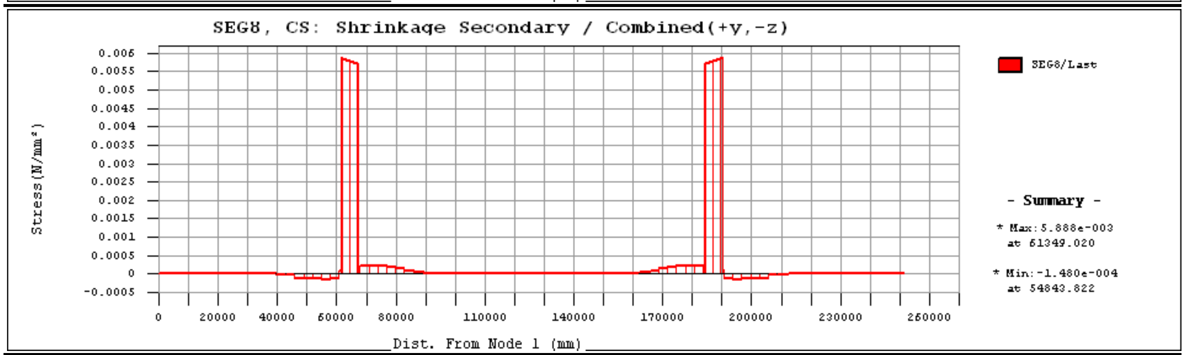

SEG8, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:2.224e+000 at 180603.614
* Min:0.000e+000 at 0.000

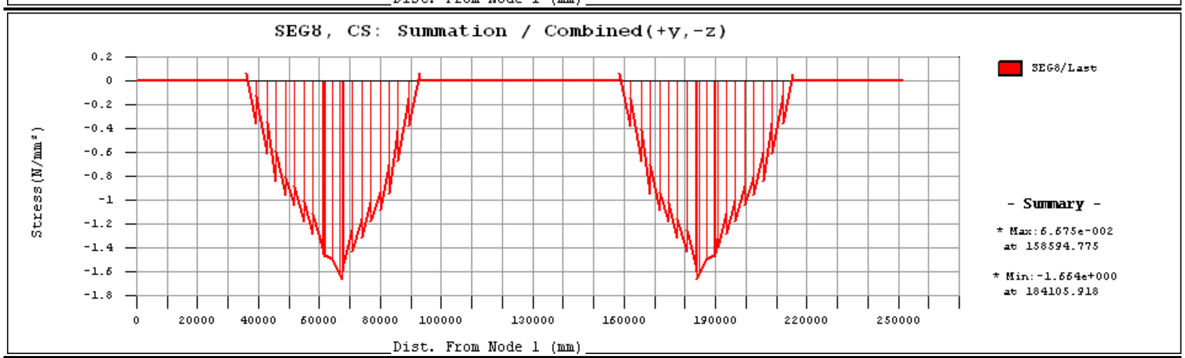

SEG8, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:2.000e-006 at 76859.209
* Min:-5.559e-002 at 67353.604


SEG8, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:6.864e-002 at 158594.775
* Min:-4.755e-001 at 184105.918

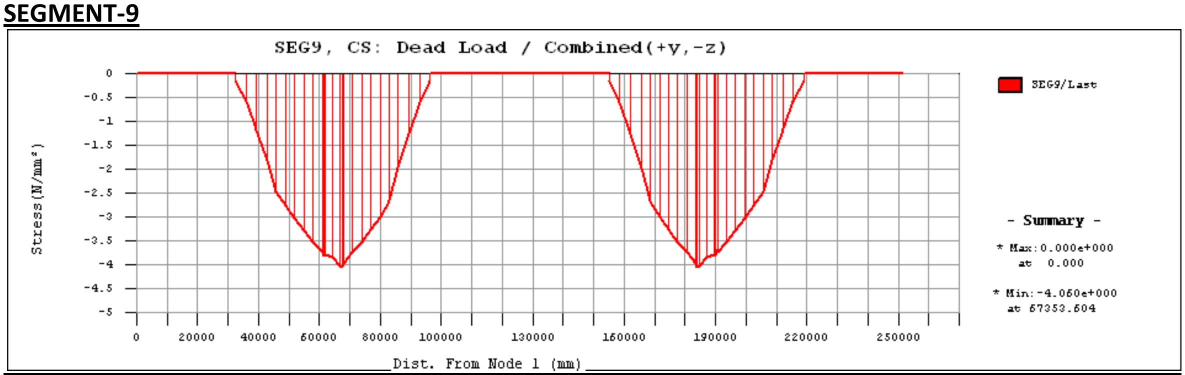

SEG8, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max:2.380e-004 at 73857.642
* Min:-2.926e-003 at 67353.604

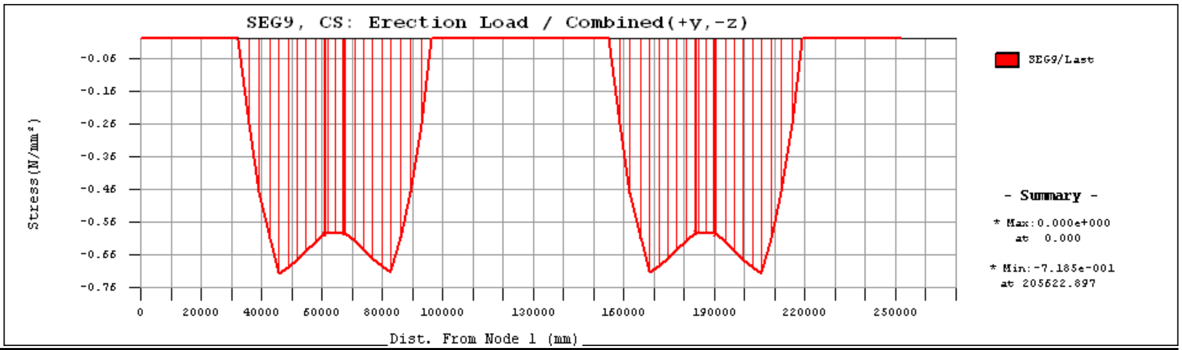

SEG8, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -1.729e+000
at 54843.822

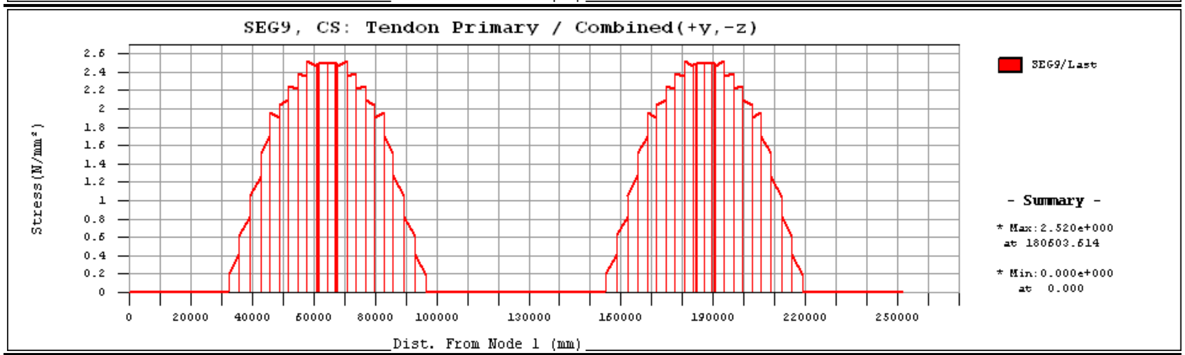

SEG8, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max: 5.888e-003
at 61349.020
* Min: -1.480e-004
at 54843.822

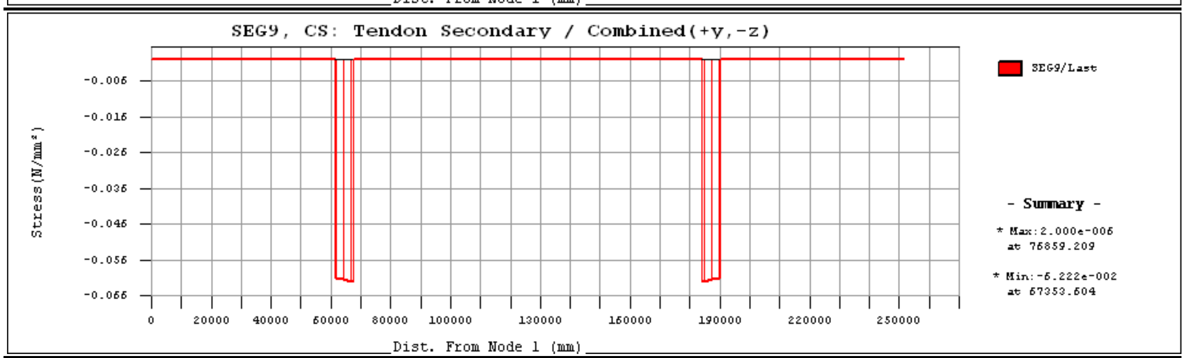

SEG8, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG8/Last
- Summary -
* Max: 6.675e-002
at 158594.775
* Min: -1.664e+000
at 184105.918

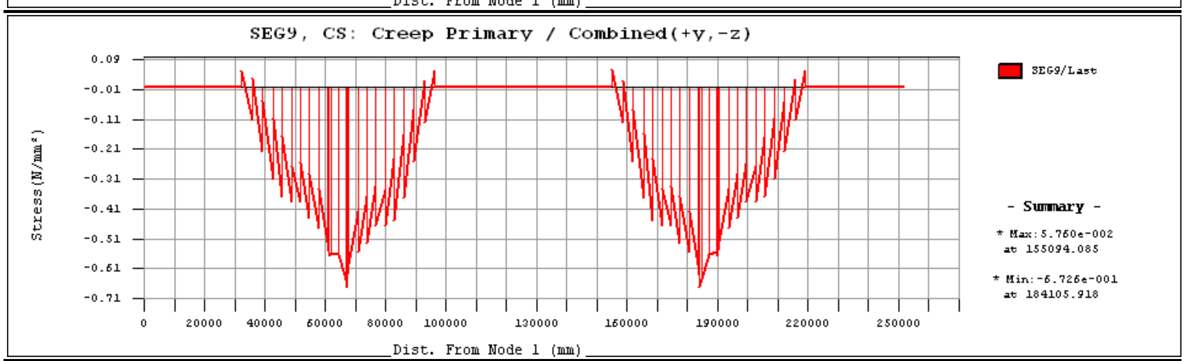
SEGMENT-9

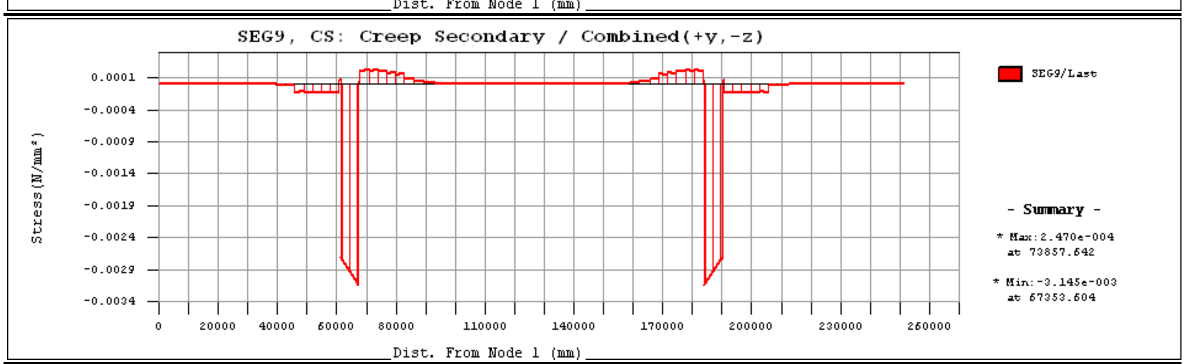

SEG9, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -4.060e+000
at 67353.604

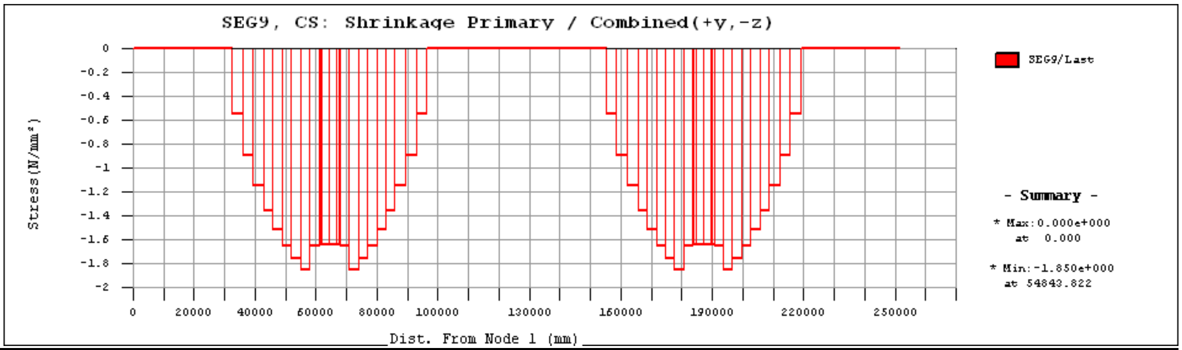

SEG9, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-7.185e-001
at 205622.897

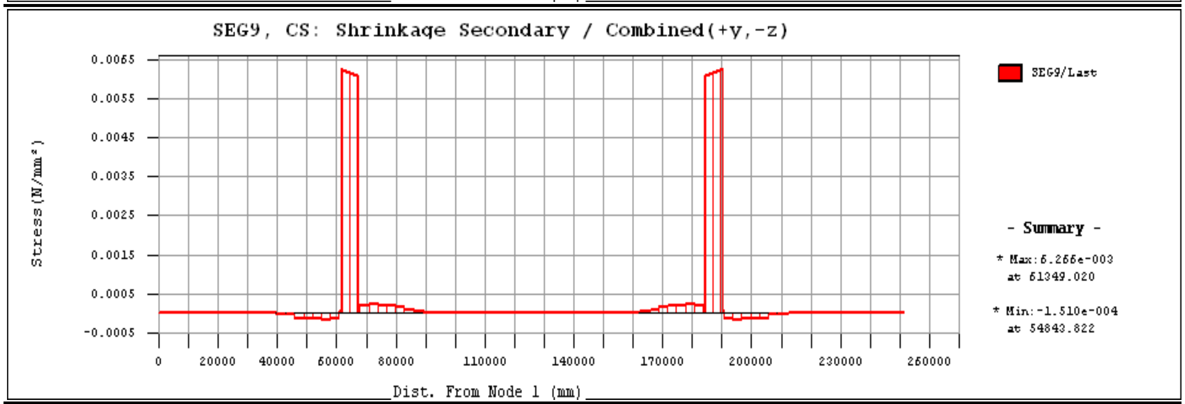

SEG9, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:2.520e+000
at 180603.614
* Min:0.000e+000
at 0.000

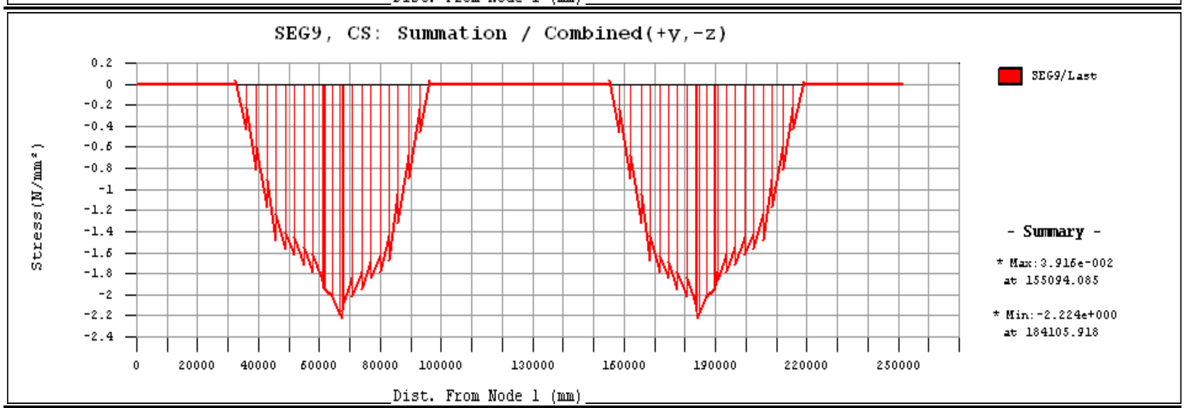

SEG9, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:2.000e-006
at 76859.209
* Min:-6.222e-002
at 67353.604


SEG9, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:5.760e-002
at 155094.085
* Min:-6.726e-001
at 184105.918

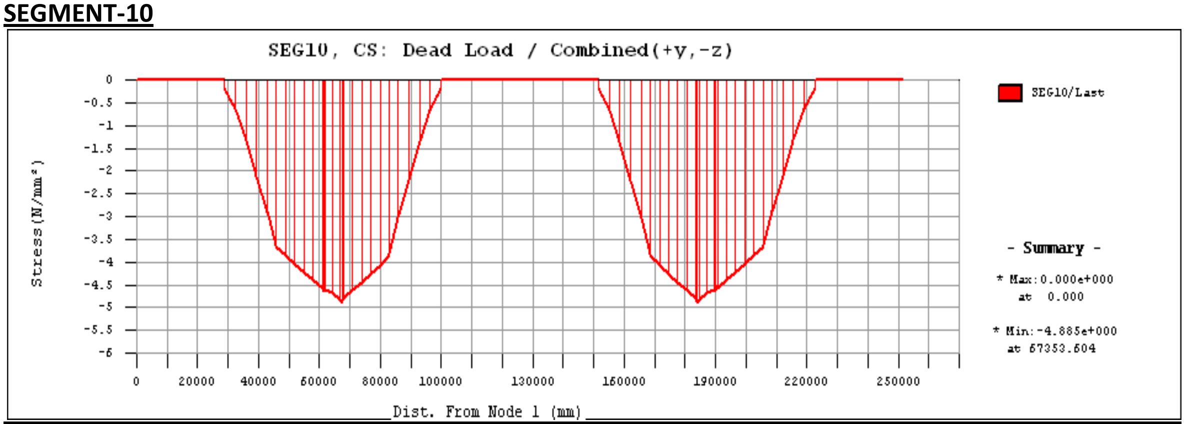

SEG9, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max:2.470e-004
at 73857.642
* Min:-3.145e-003
at 67353.604

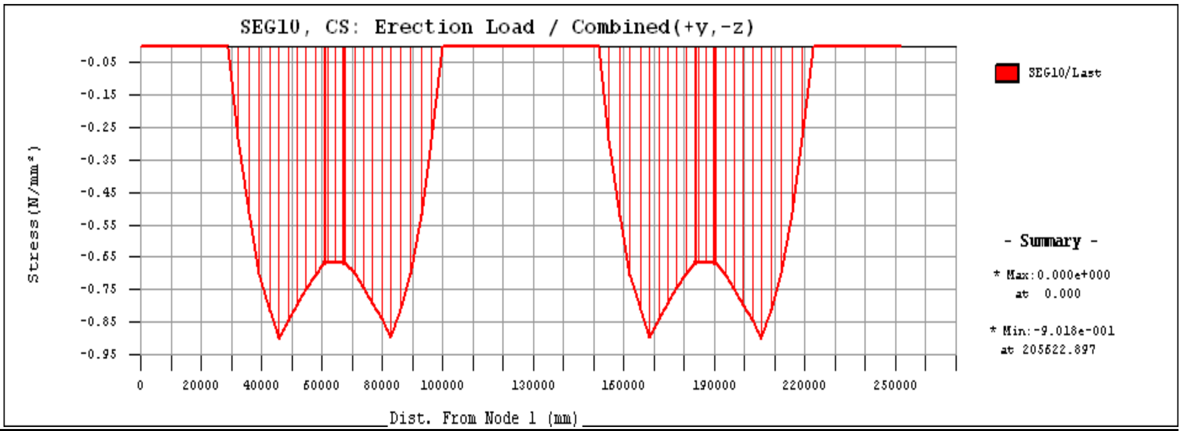

SEG9, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -1.850e+000
at 54843.822

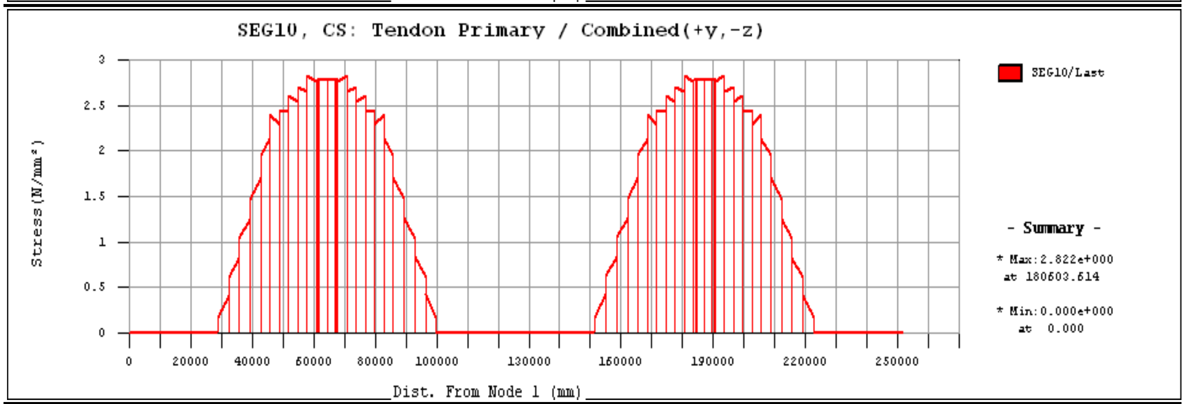

SEG9, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max: 6.266e-003
at 61349.020
* Min: -1.510e-004
at 54843.822

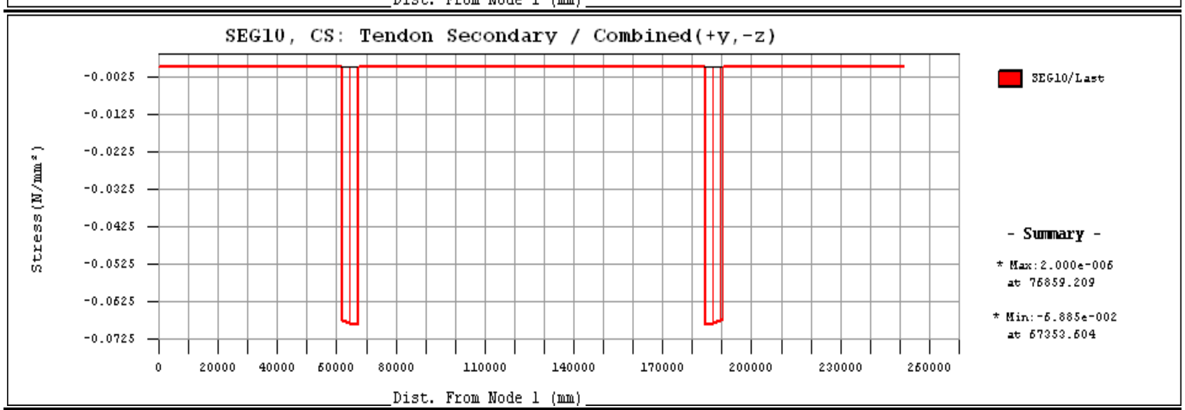

SEG9, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG9/Last
- Summary -
* Max: 3.916e-002
at 155094.085
* Min: -2.224e+000
at 184105.918

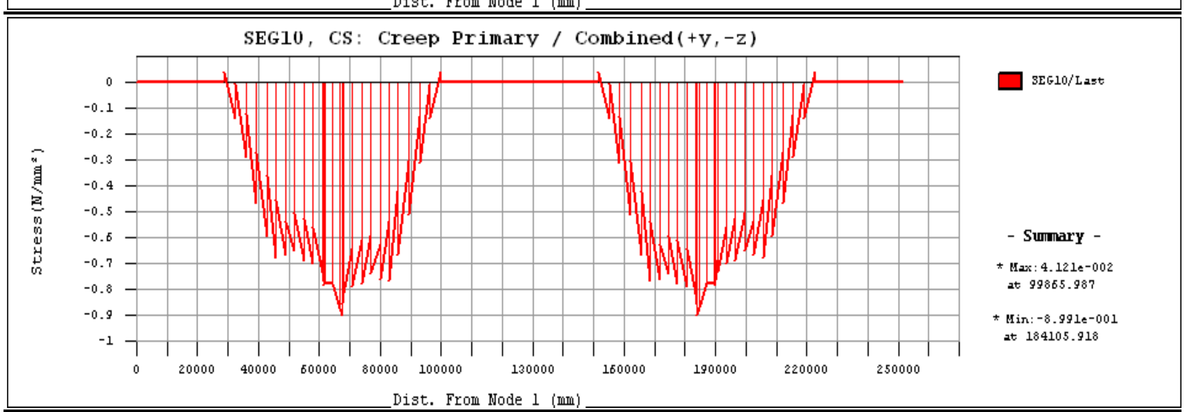
SEGMENT-10

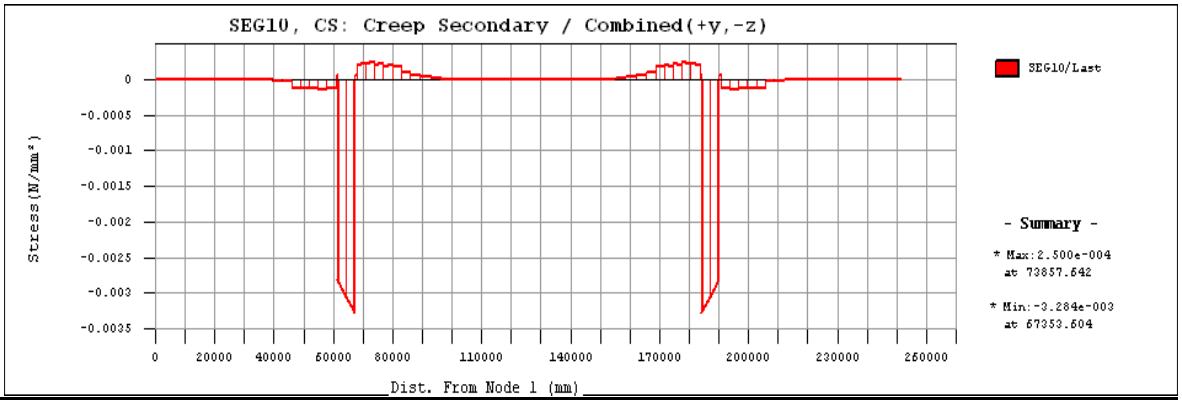

SEG10, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -4.885e+000
at 67353.604

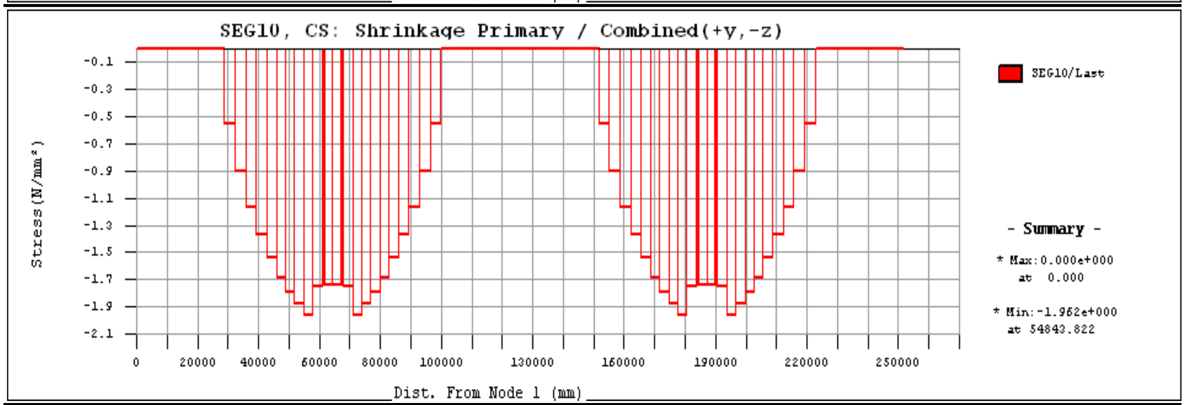

SEG10, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-9.018e-001
at 205622.897

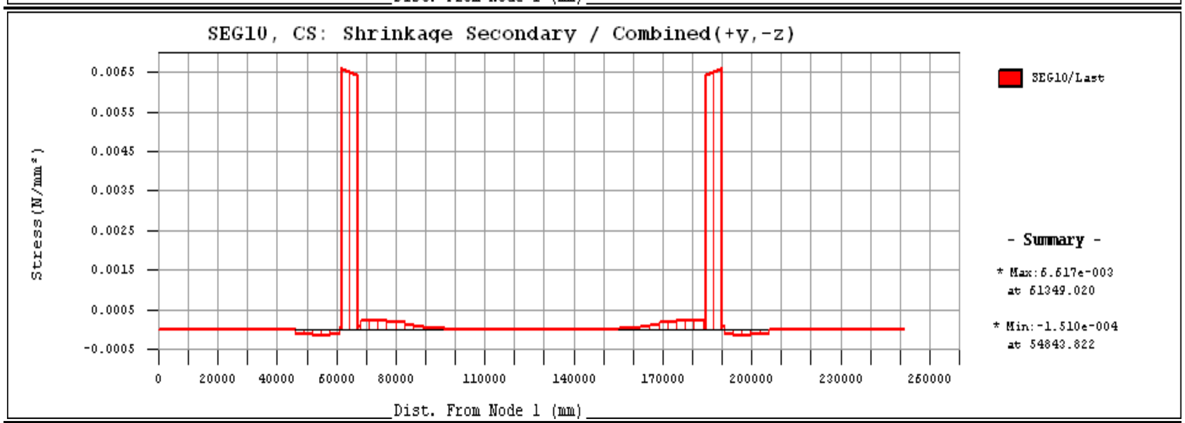

SEG10, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:2.822e+000
at 180603.614
* Min:0.000e+000
at 0.000

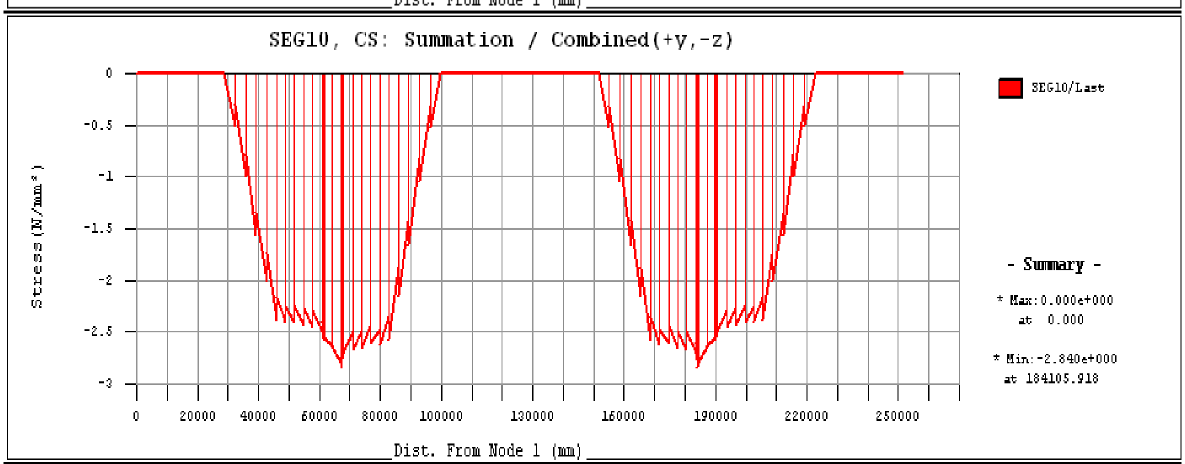

SEG10, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:2.000e-006
at 75859.209
* Min:-6.885e-002
at 67353.604


SEG10, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:4.121e-002
at 99865.987
* Min:-8.991e-001
at 184105.918

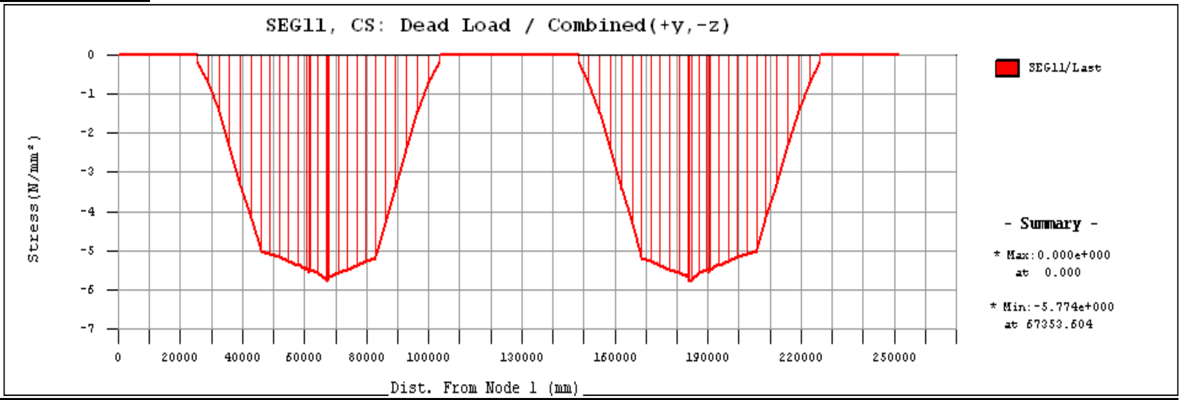

SEG10, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:2.500e-004
at 73857.642
* Min:-3.284e-003
at 67353.604


SEG10, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.962e+000
at 54843.822

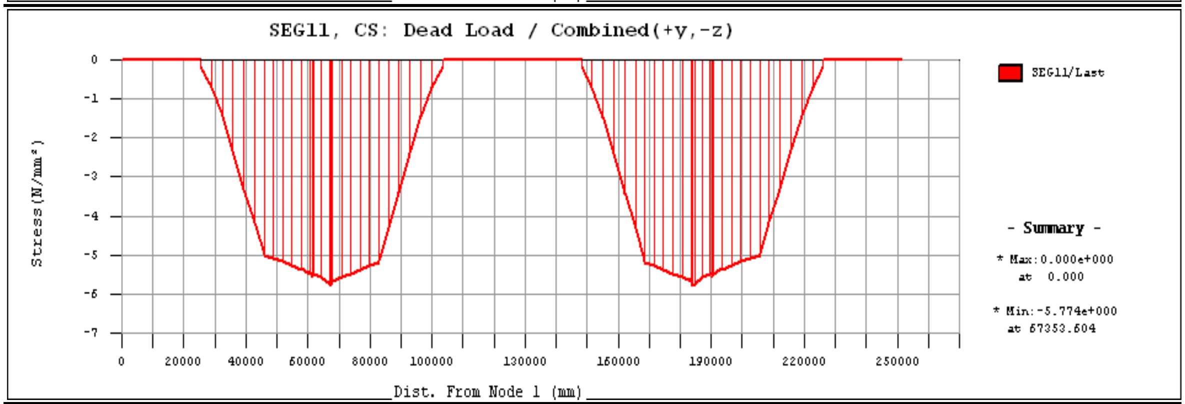

SEG10, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:6.617e-003
at 61349.020
* Min:-1.510e-004
at 54843.822


SEG10, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG10/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.840e+000
at 184105.918

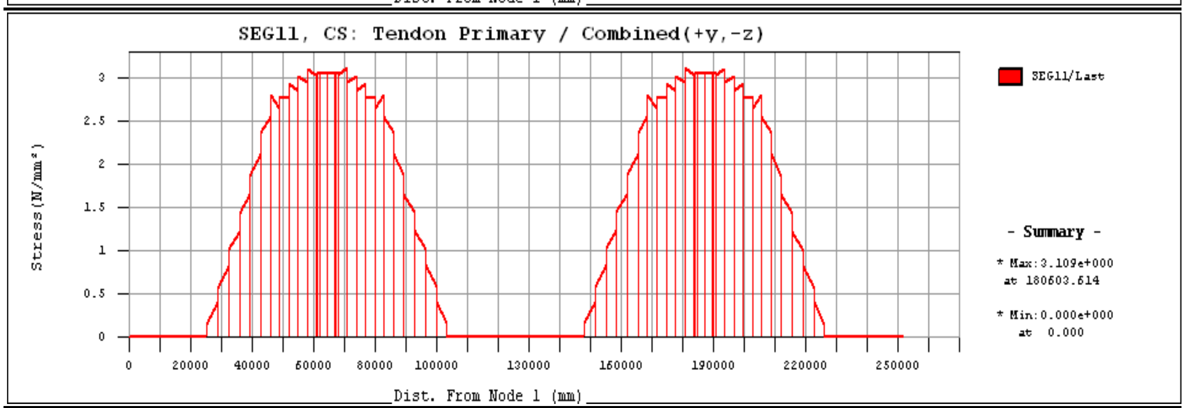
SEGMENT-11



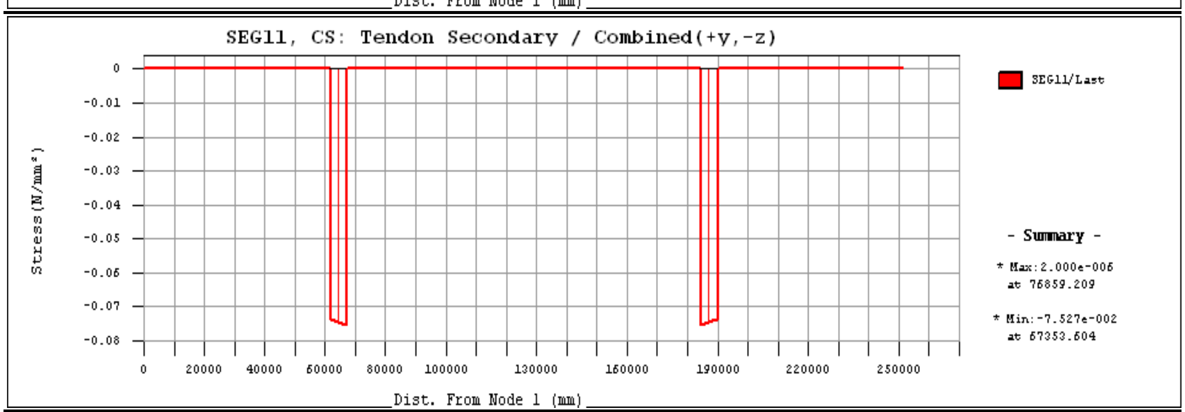
SEG11, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -5.774e+000 at 67353.604



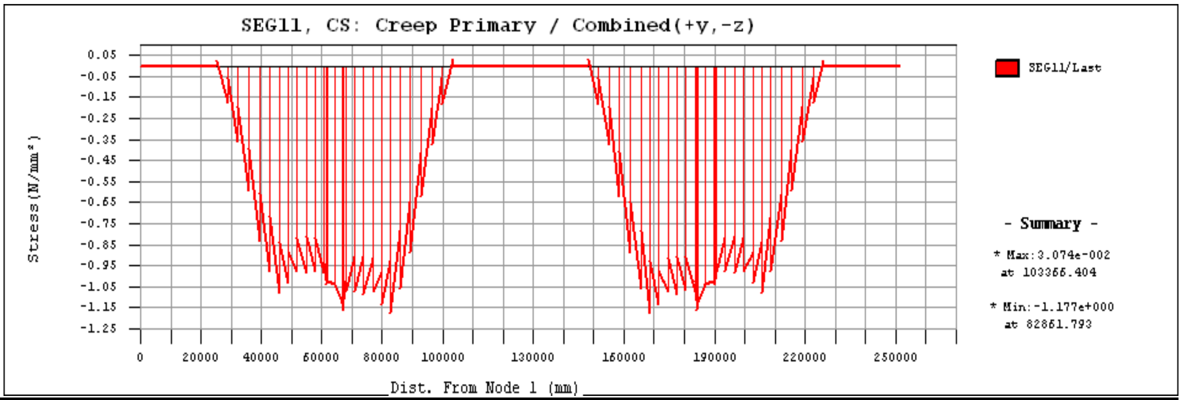
SEG11, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -5.774e+000 at 67353.604

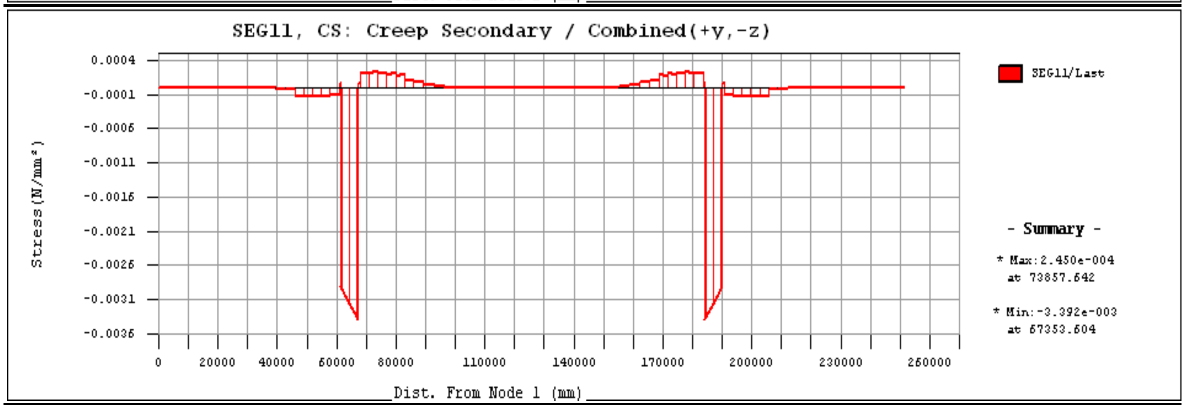


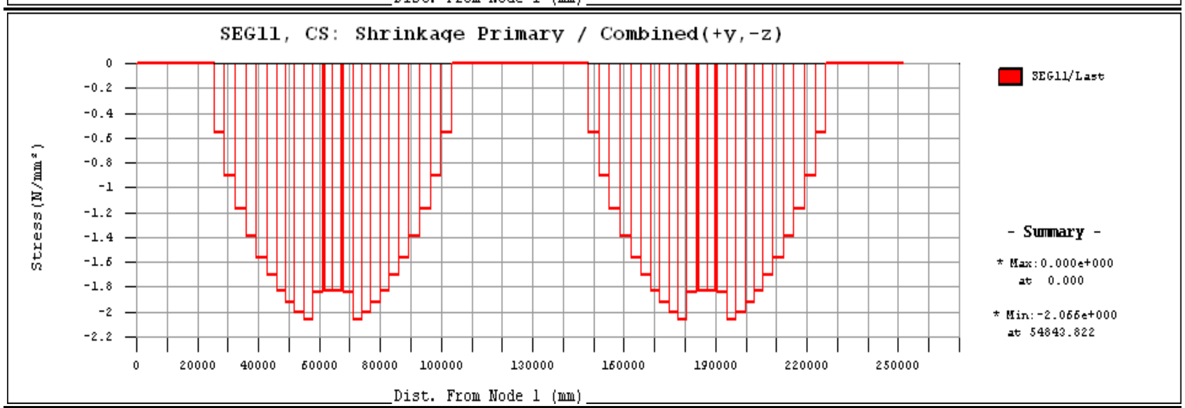
SEG11, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max: 3.109e+000 at 180603.614
* Min: 0.000e+000 at 0.000

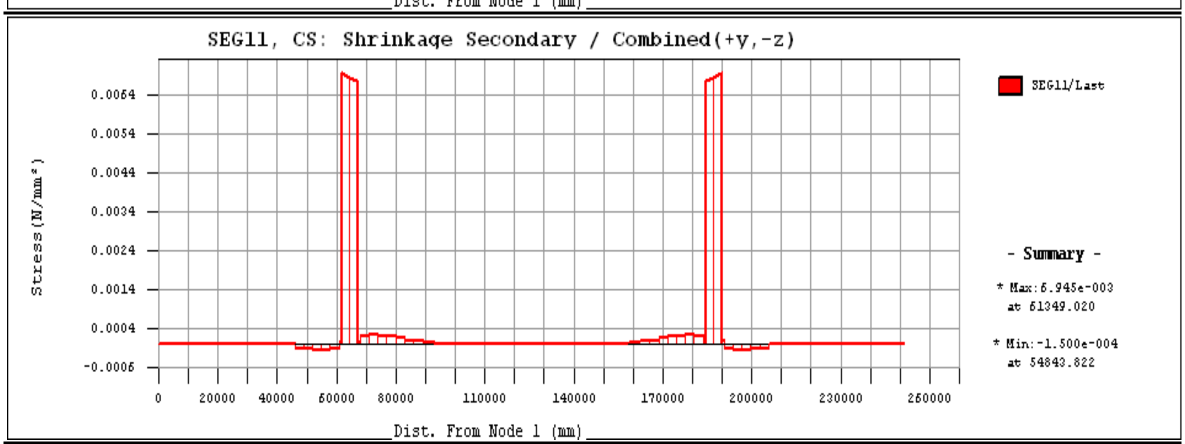


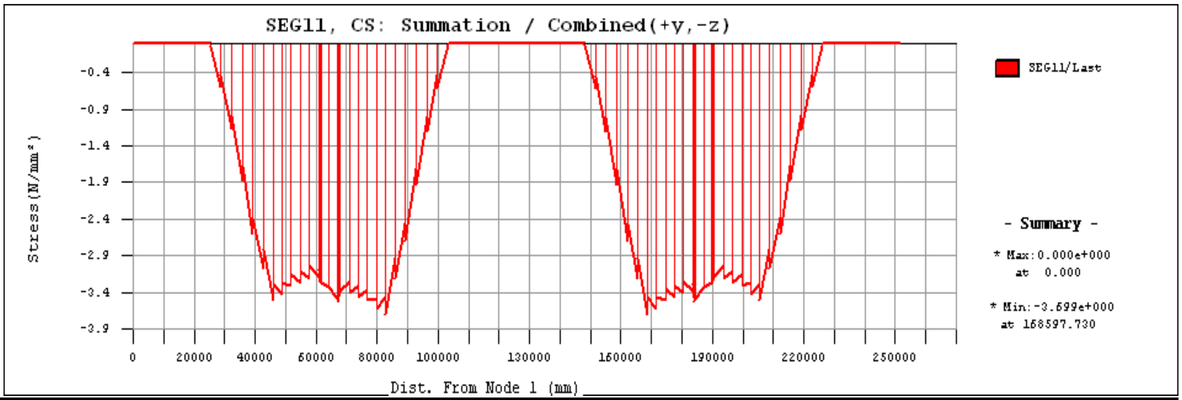
SEG11, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max: 2.000e-006 at 76859.209
* Min: -7.527e-002 at 67353.604


SEG11, CS: Creep Primary / Combined(+y,-z)
SEG11/Last
- Summary -
* Max:3.074e-002
at 103366.404
* Min:-1.177e+000
at 82861.793
Stress(N/mm²)
Dist. From Node 1 (mm)

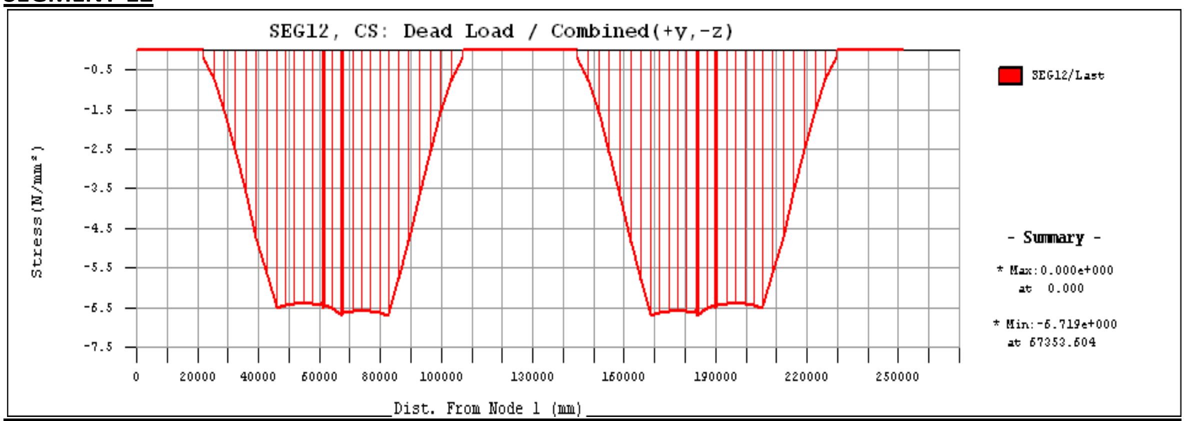

SEG11, CS: Creep Secondary / Combined(+y,-z)
SEG11/Last
- Summary -
* Max:2.450e-004
at 73857.642
* Min:-3.392e-003
at 67353.604
Stress(N/mm²)
Dist. From Node 1 (mm)

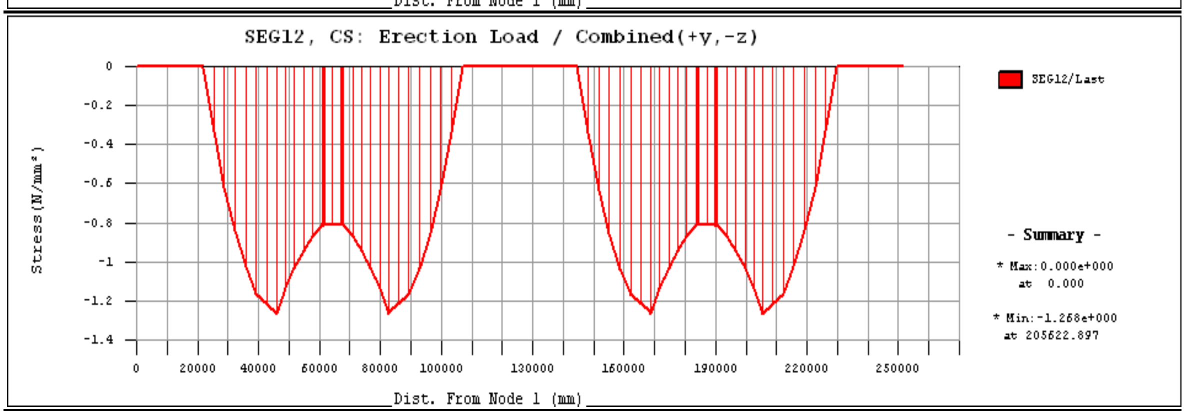

SEG11, CS: Shrinkage Primary / Combined(+y,-z)
SEG11/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.066e+000
at 54843.822
Stress(N/mm²)
Dist. From Node 1 (mm)

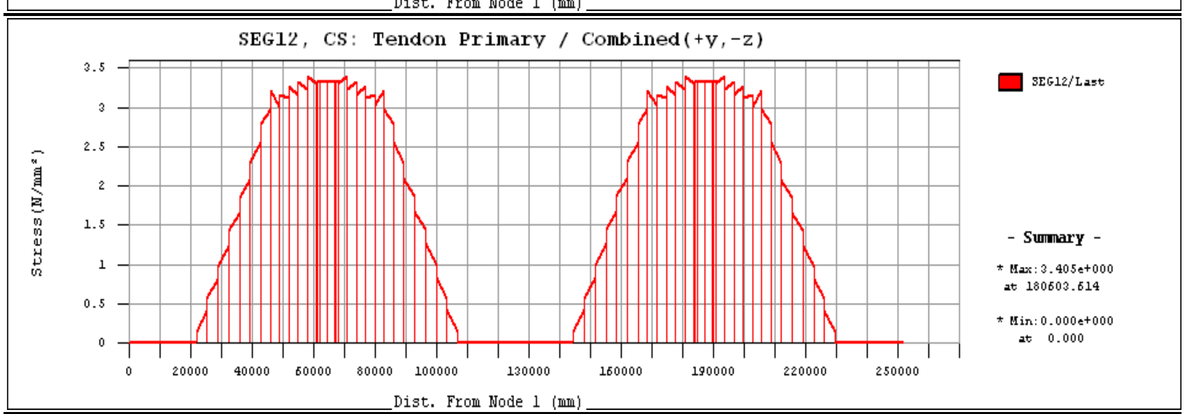

SEG11, CS: Shrinkage Secondary / Combined(+y,-z)
SEG11/Last
- Summary -
* Max:6.945e-003
at 61349.020
* Min:-1.500e-004
at 54843.822
Stress(N/mm²)
Dist. From Node 1 (mm)

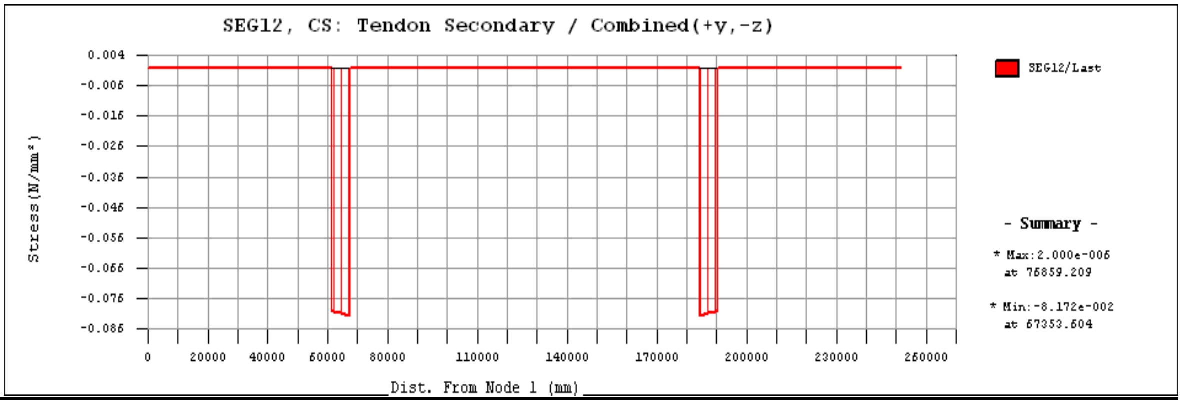

SEG11, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG11/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-3.699e+000
at 168597.730

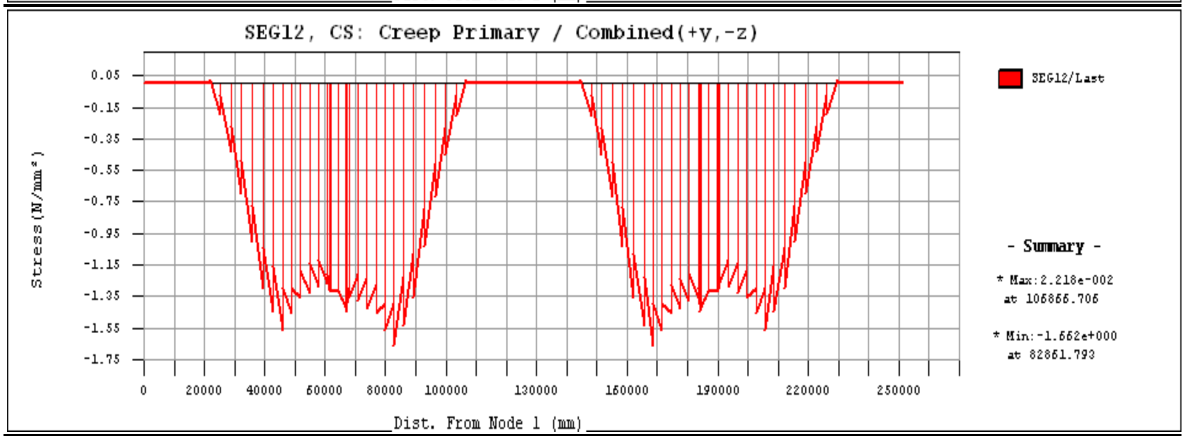
SEGMENT-12

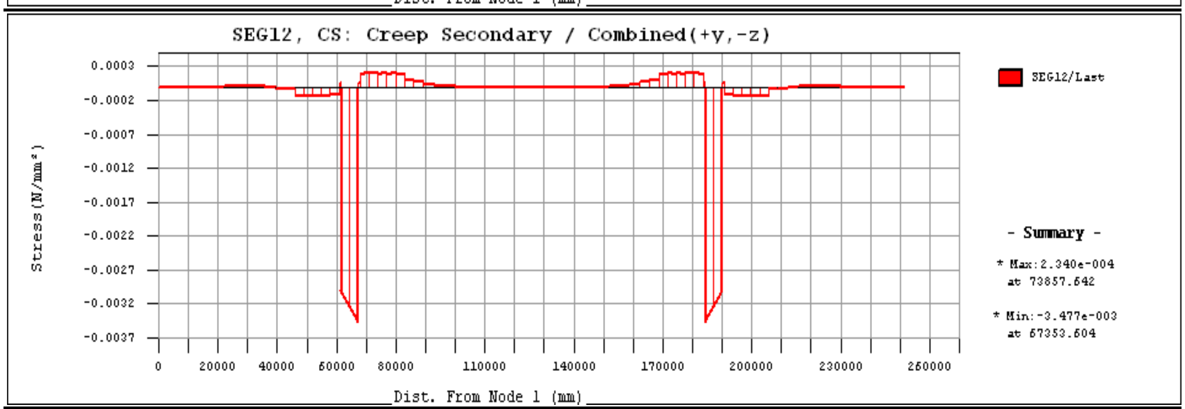

SEG12, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-6.719e+000
at 67353.604

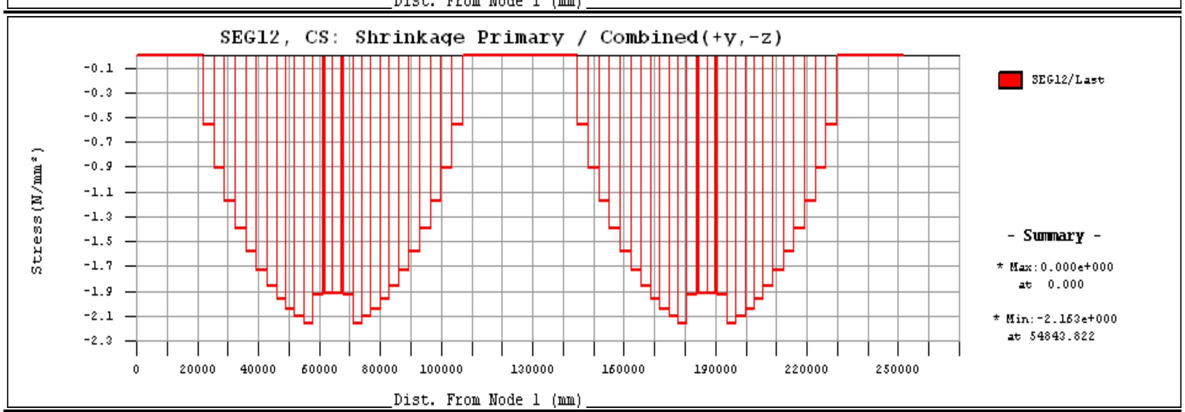

SEG12, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.268e+000
at 205622.897

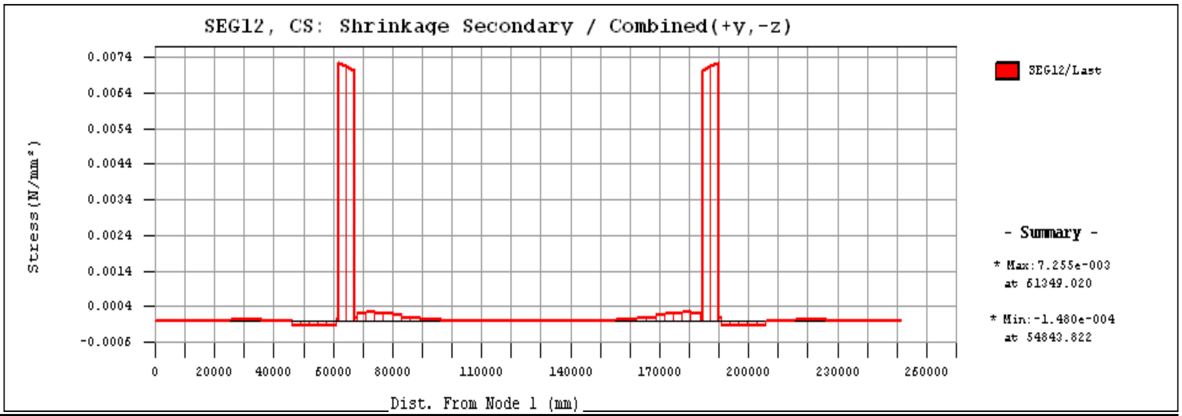

SEG12, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:3.405e+000
at 180603.614
* Min:0.000e+000
at 0.000

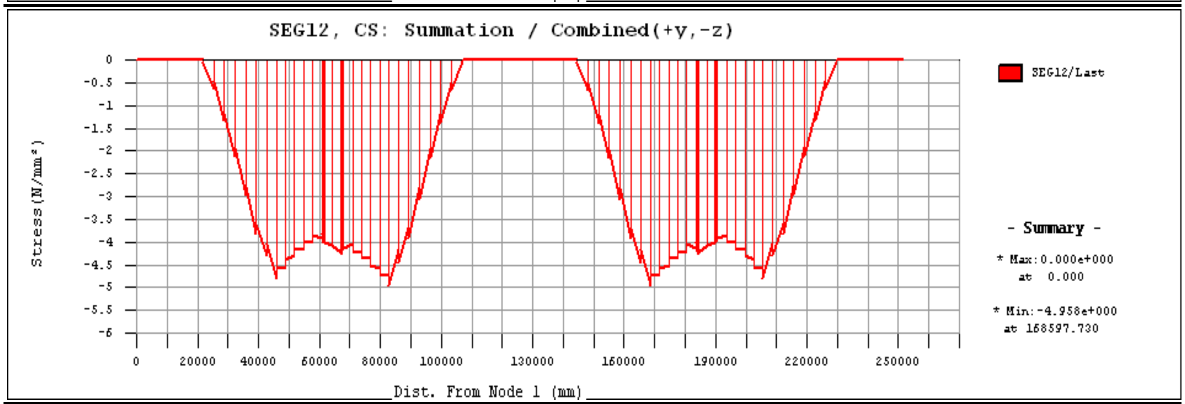

SEG12, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:2.000e-006
at 76859.209
* Min:-8.172e-002
at 67353.604


SEG12, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:2.218e-002
at 106866.706
* Min:-1.662e+000
at 82861.793

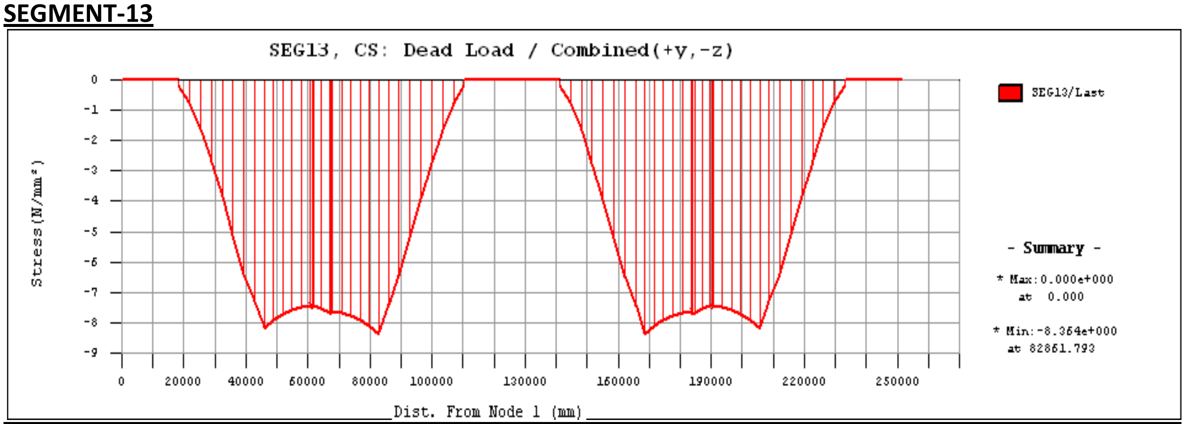

SEG12, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:2.340e-004
at 73857.642
* Min:-3.477e-003
at 67353.604

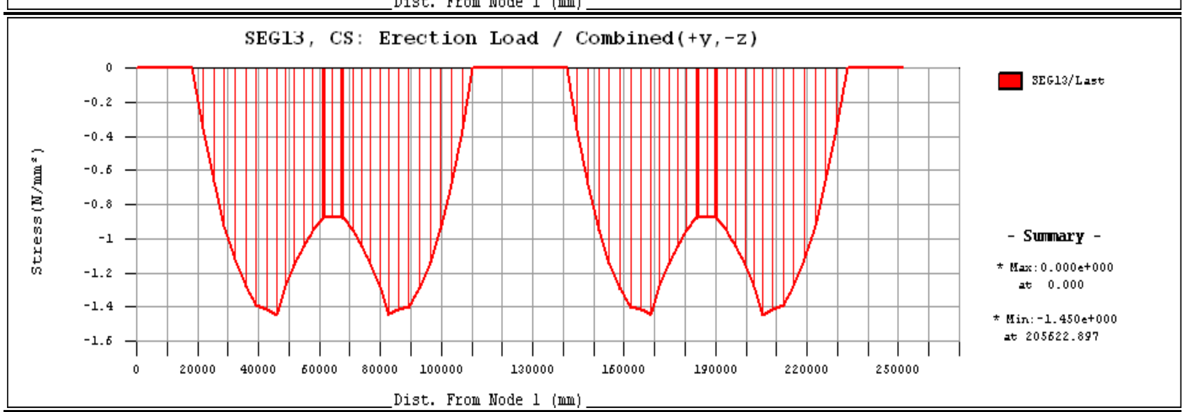

SEG12, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.163e+000
at 54843.822

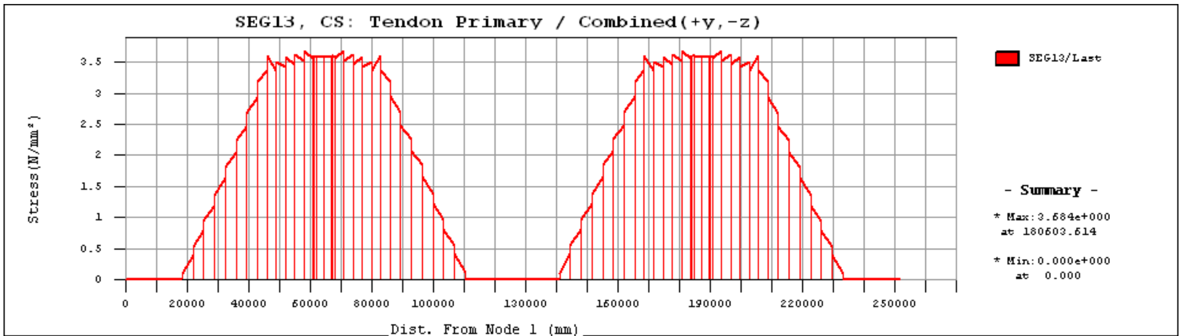

SEG12, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:7.255e-003
at 61349.020
* Min:-1.480e-004
at 54843.822

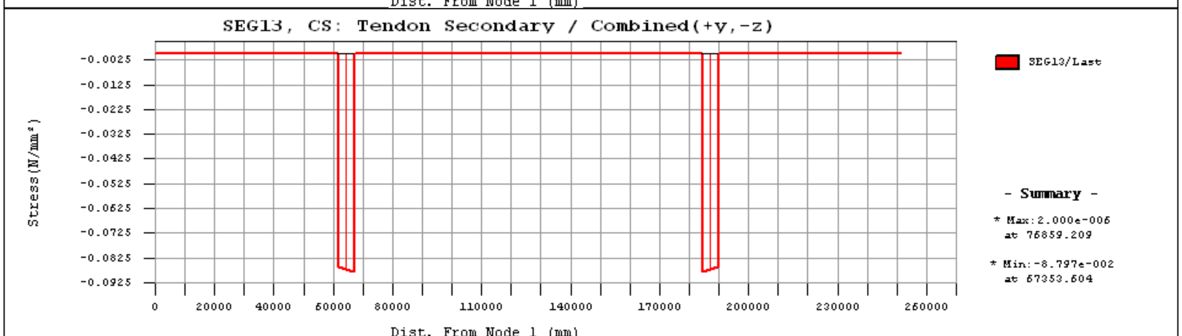

SEG12, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG12/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-4.958e+000
at 168597.730

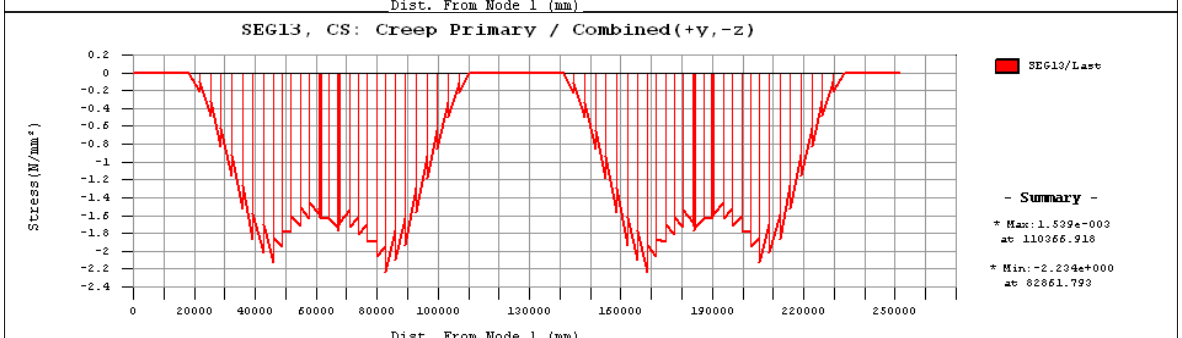
SEGMENT-13

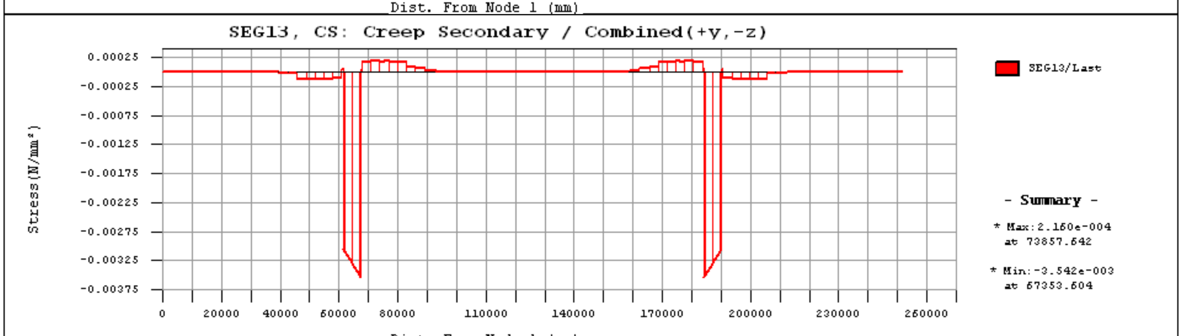

SEG13, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-8.364e+000
at 82861.793

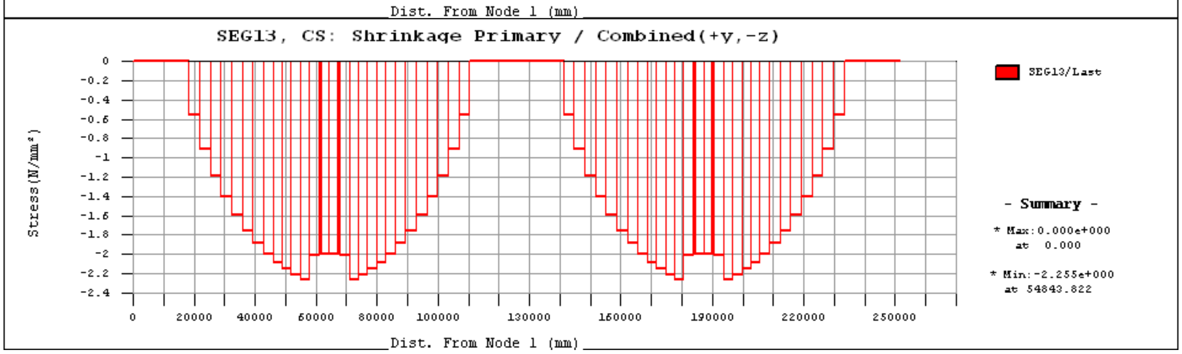

SEG13, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-1.450e+000
at 205622.897

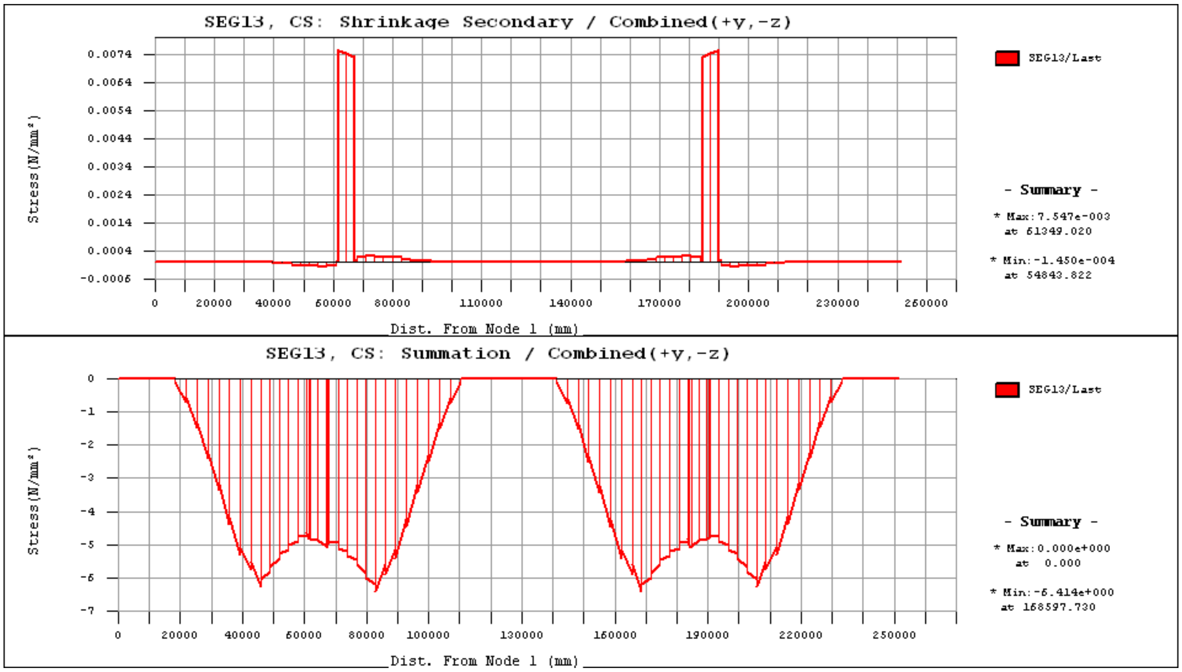

SEG13, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:3.684e+000
at 180603.614
* Min:0.000e+000
at 0.000


SEG13, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:2.000e-006
at 76859.209
* Min:-8.797e-002
at 67353.604

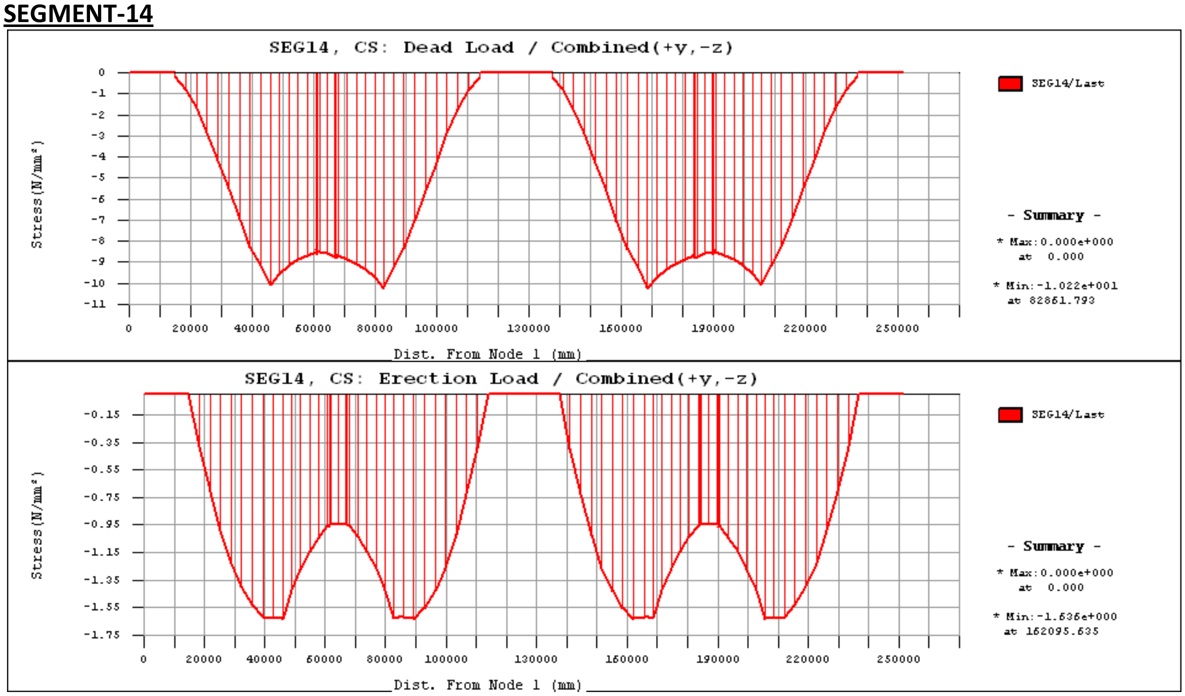

SEG13, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:1.539e-003
at 110366.918
* Min:-2.234e+000
at 82861.793

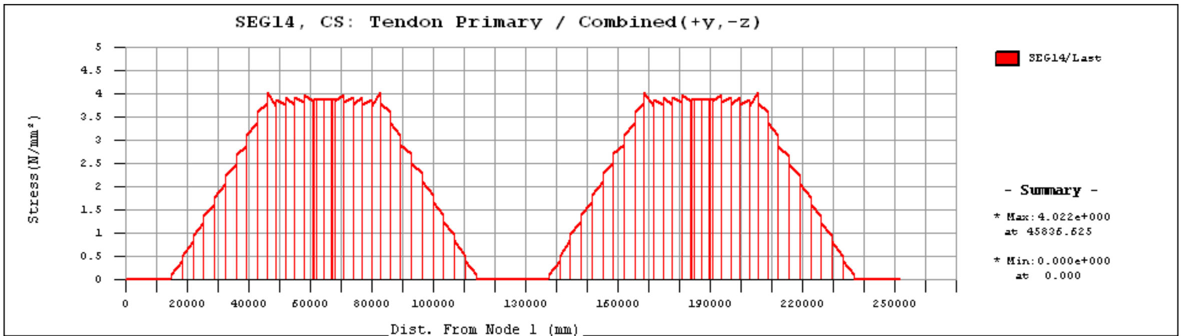

SEG13, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:2.150e-004
at 73857.642
* Min:-3.542e-003
at 67353.604

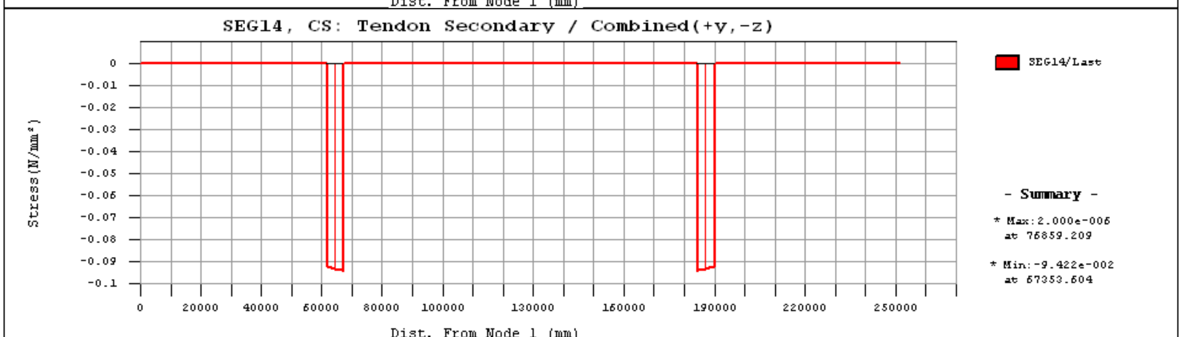

SEG13, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.255e+000
at 54843.822

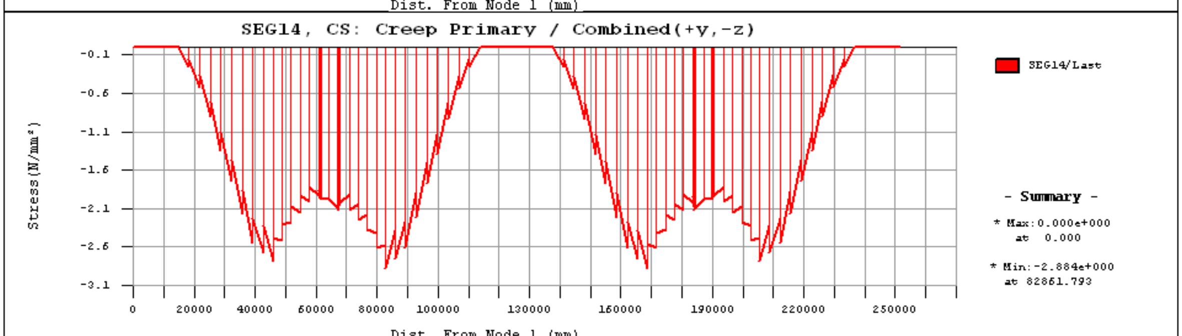

SEG13, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max: 7.547e-003 at 61349.020
* Min: -1.450e-004 at 54843.822
SEG13, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG13/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -6.414e+000 at 158597.730

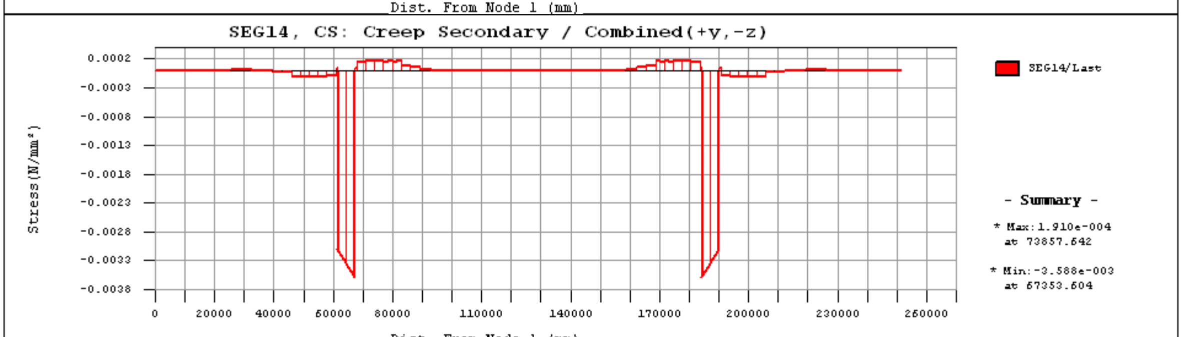
SEGMENT-14

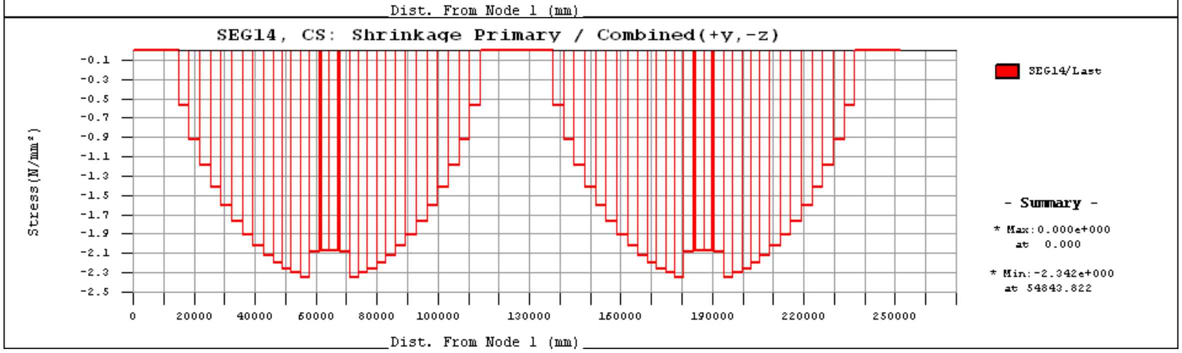

SEG14, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -1.022e+001 at 82861.793
SEG14, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -1.636e+000 at 152095.635

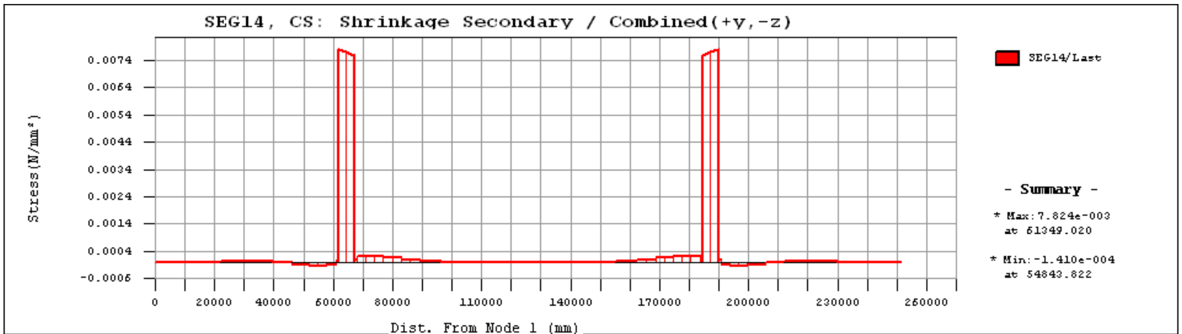

SEG14, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max:4.022e+000
at 45836.625
* Min:0.000e+000
at 0.000

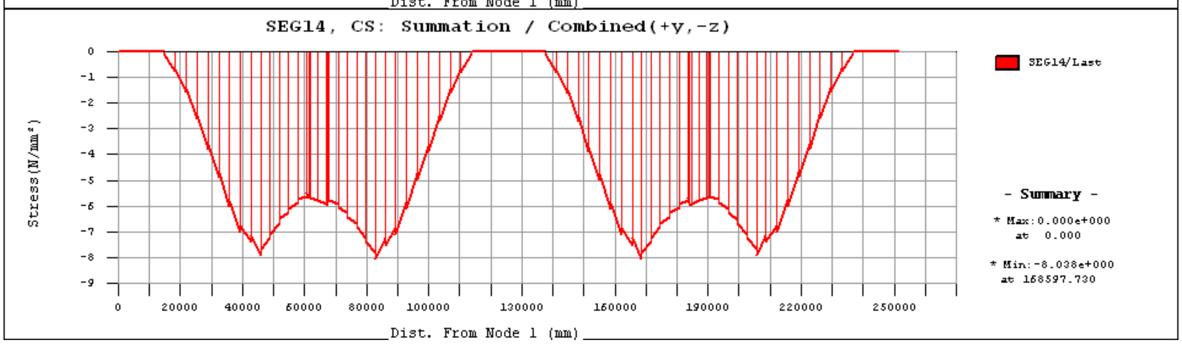

SEG14, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max:2.000e-006
at 76859.209
* Min:-9.422e-002
at 67353.604


SEG14, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.884e+000
at 82861.793

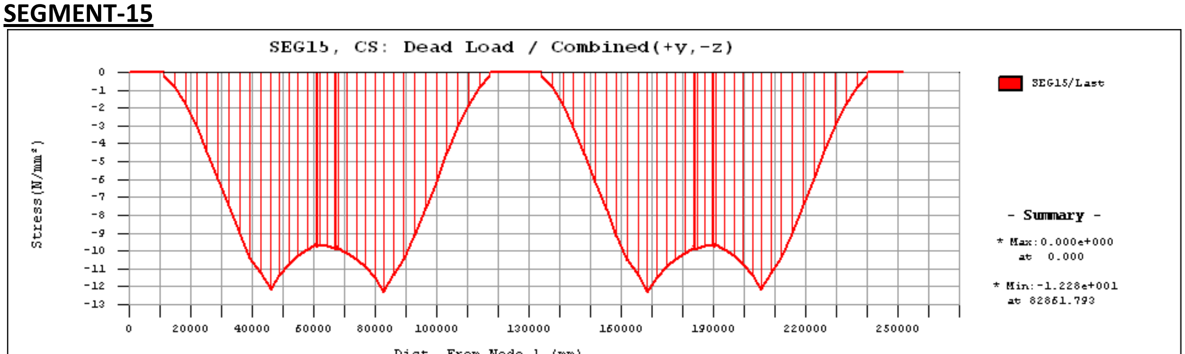

SEG14, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max:1.910e-004
at 73857.642
* Min:-3.588e-003
at 67353.604

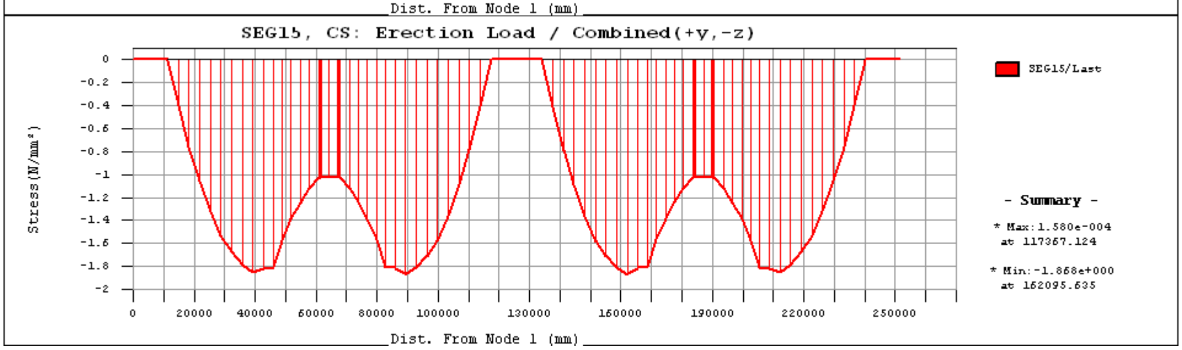

SEG14, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max:0.000e+000
at 0.000
* Min:-2.342e+000
at 54843.822

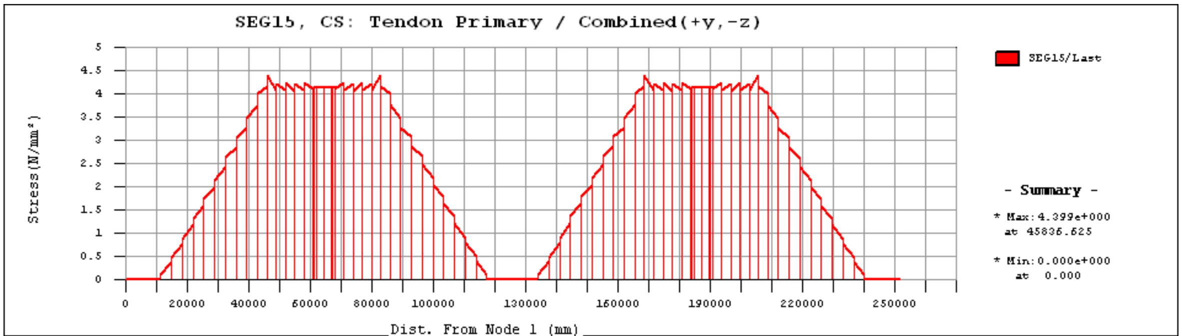

SEG14, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max: 7.824e-003 at 61349.020
* Min: -1.410e-004 at 54843.822

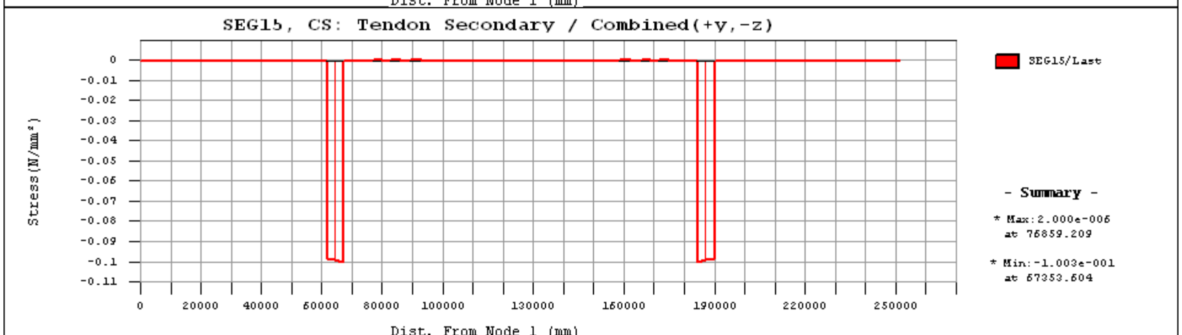

SEG14, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG14/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -8.038e+000 at 168597.730

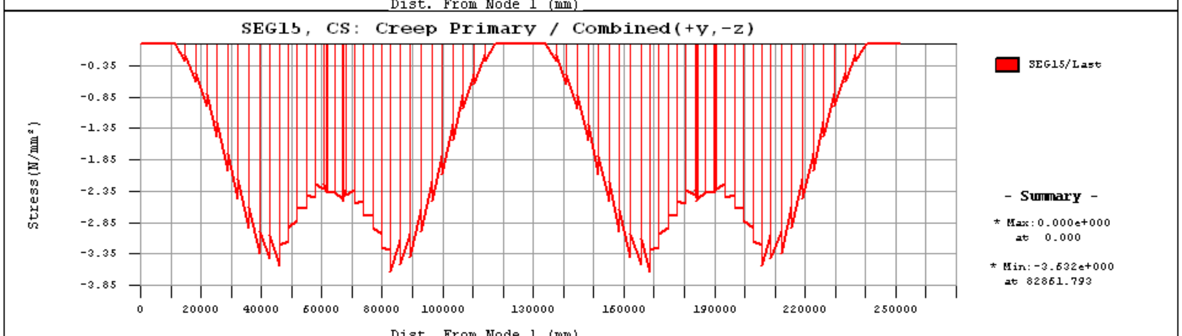
SEGMENT-15


SEG15, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -1.228e+001 at 82861.793

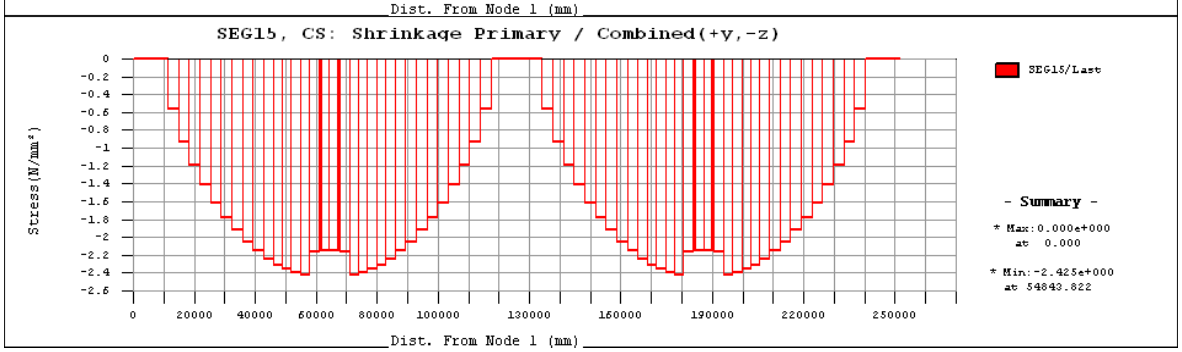

SEG15, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 1.580e-004 at 117367.124
* Min: -1.868e+000 at 162095.635

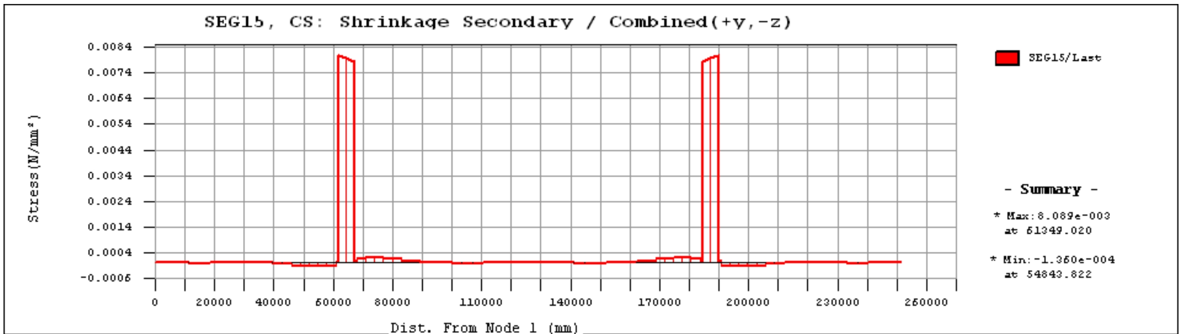

SEG15, CS: Tendon Primary / Combined(+y,-z)
SEG15/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 4.399e+000
at 45836.625
* Min: 0.000e+000
at 0.000

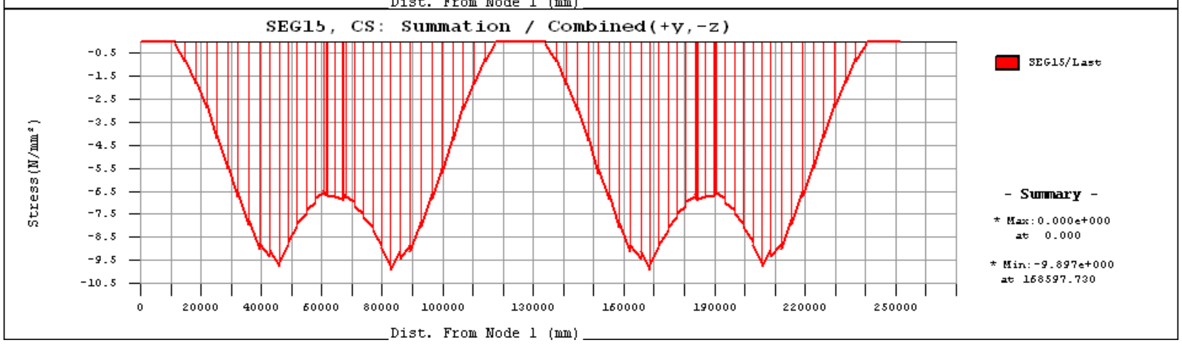

SEG15, CS: Tendon Secondary / Combined(+y,-z)
SEG15/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 2.000e-006
at 76859.209
* Min: -1.003e-001
at 67353.604


SEG15, CS: Creep Primary / Combined(+y,-z)
SEG15/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -3.632e+000
at 82861.793

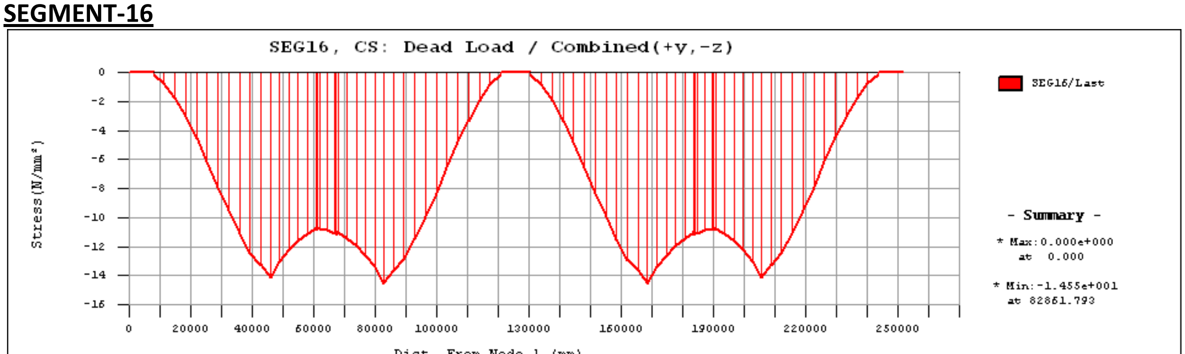

SEG15, CS: Creep Secondary / Combined(+y,-z)
SEG15/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 1.590e-004
at 73857.642
* Min: -3.614e-003
at 67353.604

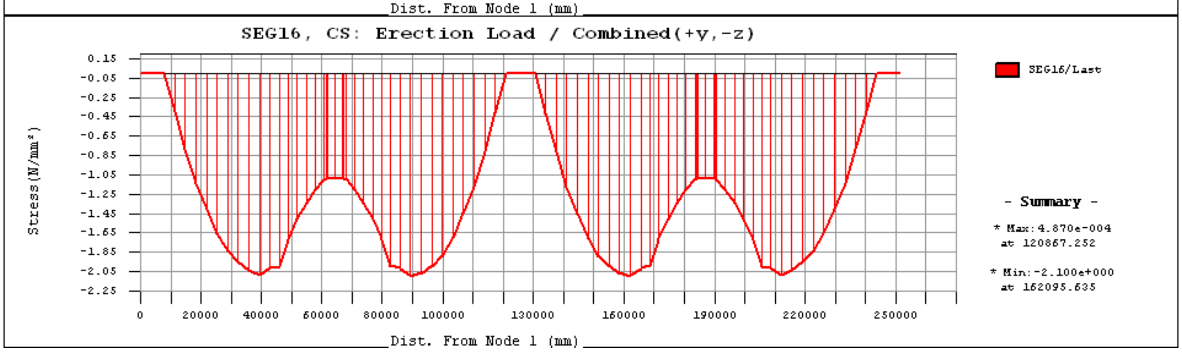

SEG15, CS: Shrinkage Primary / Combined(+y,-z)
SEG15/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -2.425e+000
at 54843.822

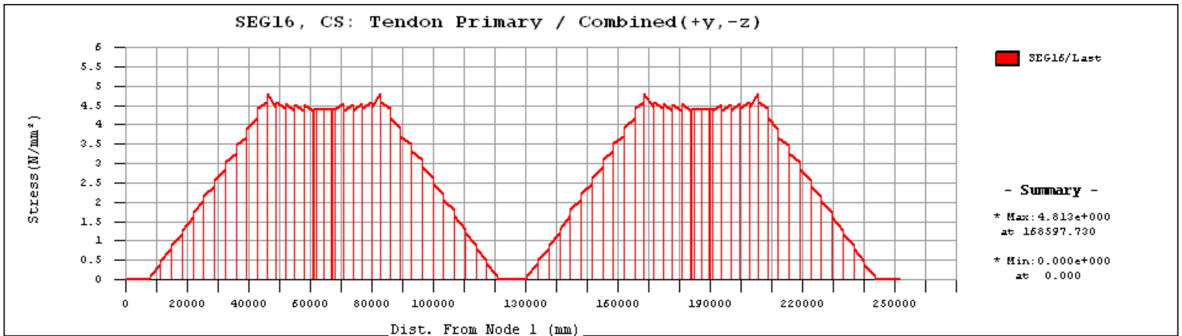

SEG15, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 8.089e-003
at 61349.020
* Min: -1.360e-004
at 54843.822

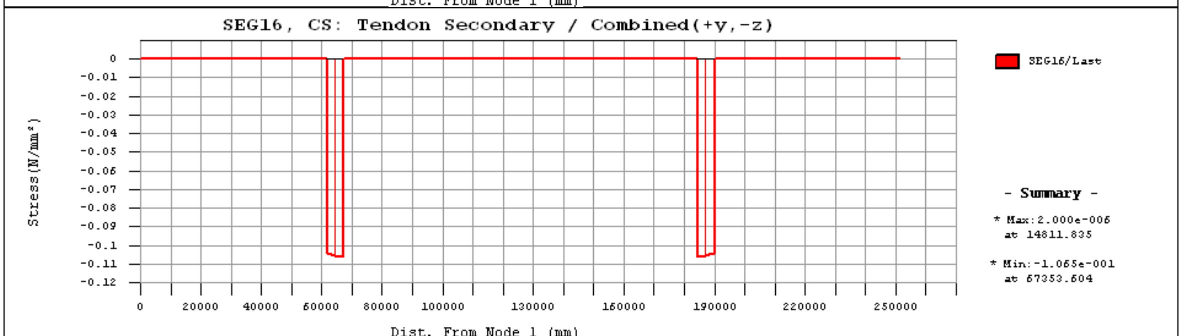

SEG15, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG15/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -9.897e+000
at 168597.730

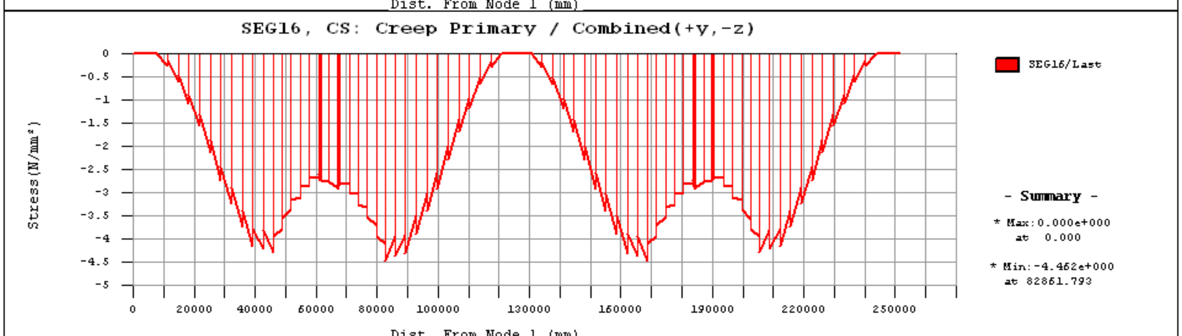
SEGMENT-16

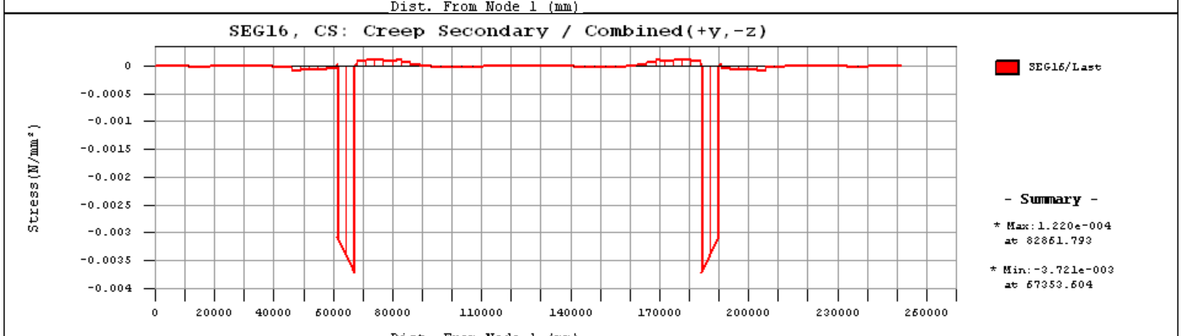

SEG16, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -1.455e+001
at 82861.793

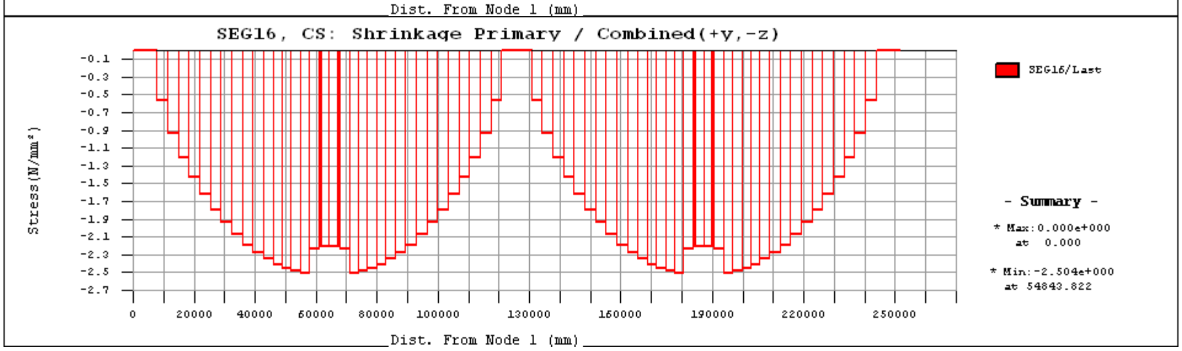

SEG16, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 4.870e-004
at 120867.252
* Min: -2.100e+000
at 162095.635

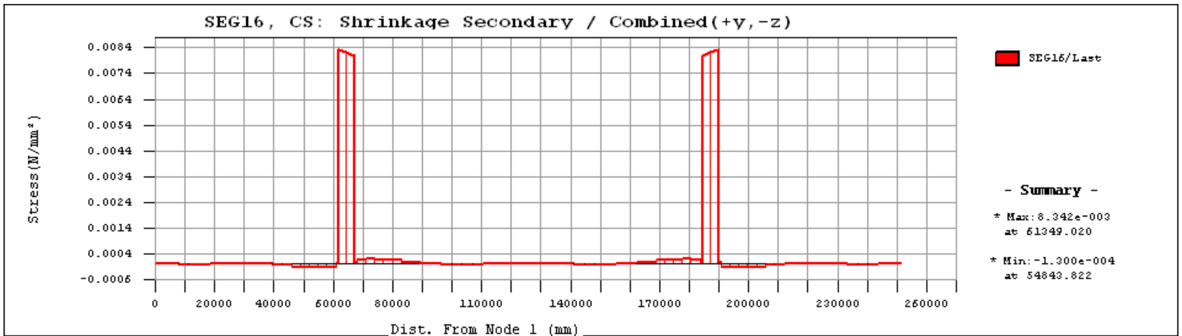

SEG16, CS: Tendon Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 4.813e+000
at 168597.730
* Min: 0.000e+000
at 0.000

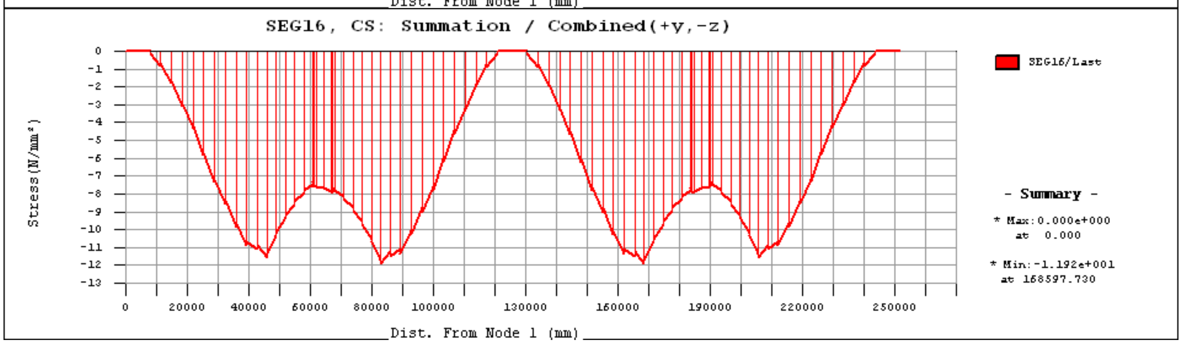

SEG16, CS: Tendon Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 2.000e-006
at 14811.835
* Min: -1.065e-001
at 67353.604


SEG16, CS: Creep Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -4.462e+000
at 82861.793

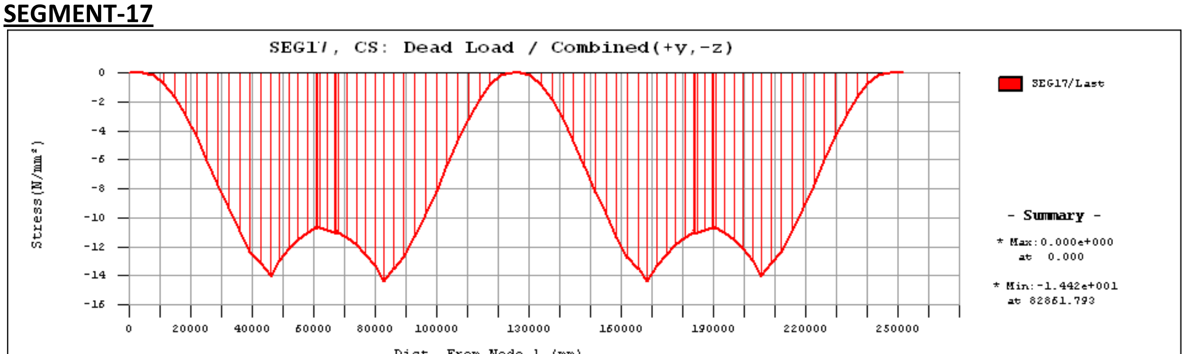

SEG16, CS: Creep Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 1.220e-004
at 82861.793
* Min: -3.721e-003
at 67353.604

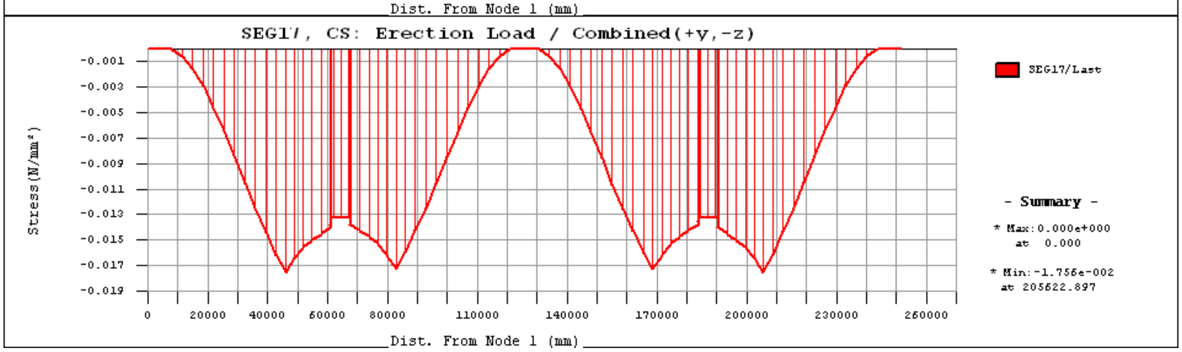

SEG16, CS: Shrinkage Primary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 0.000e+000
at 0.000
* Min: -2.504e+000
at 54843.822

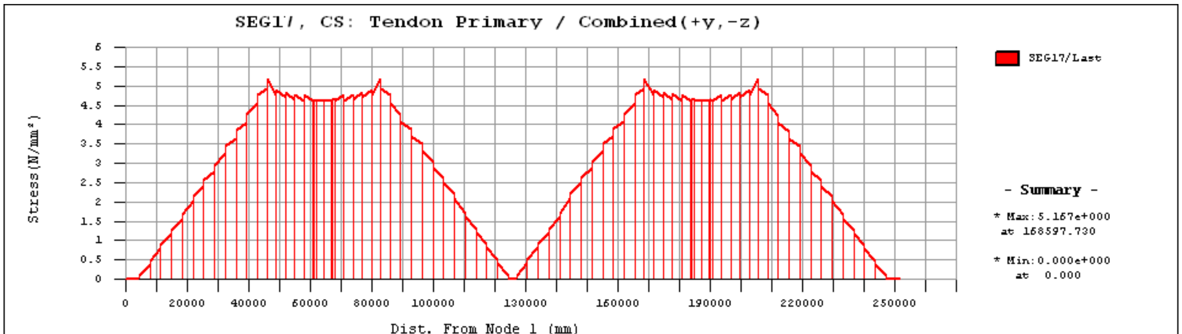

SEG16, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 8.342e-003 at 61349.020
* Min: -1.300e-004 at 54843.822

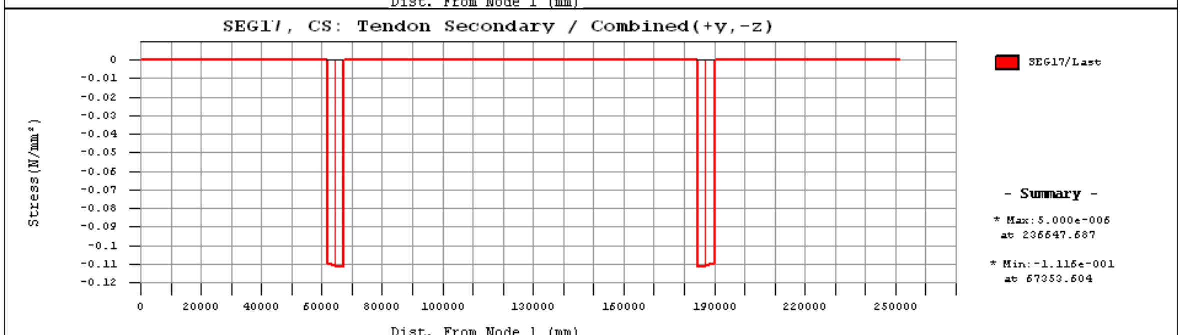

SEG16, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG16/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -1.192e+001 at 168597.730

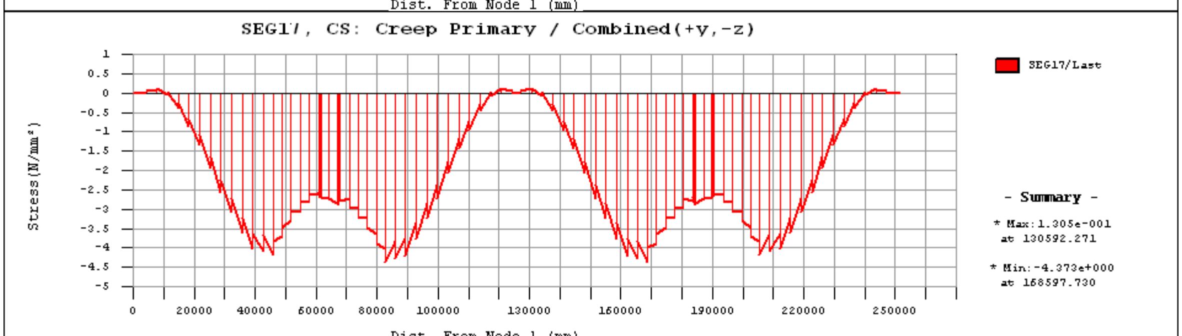
SEGMENT-17

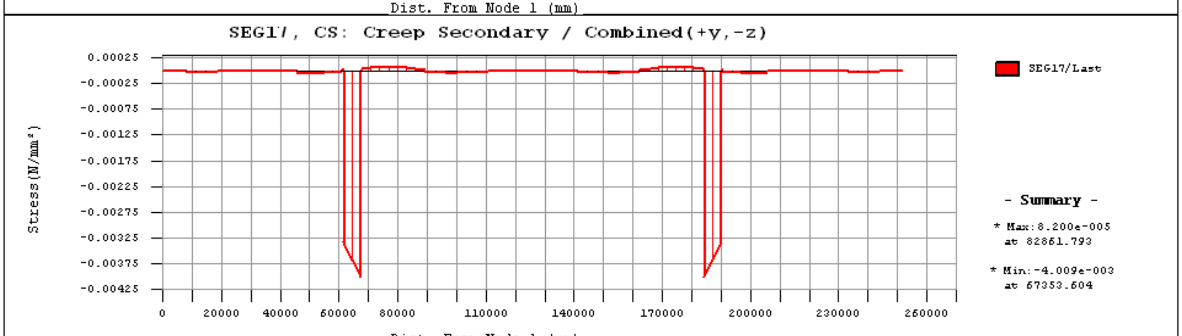

SEG17, CS: Dead Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -1.442e+001 at 82861.793

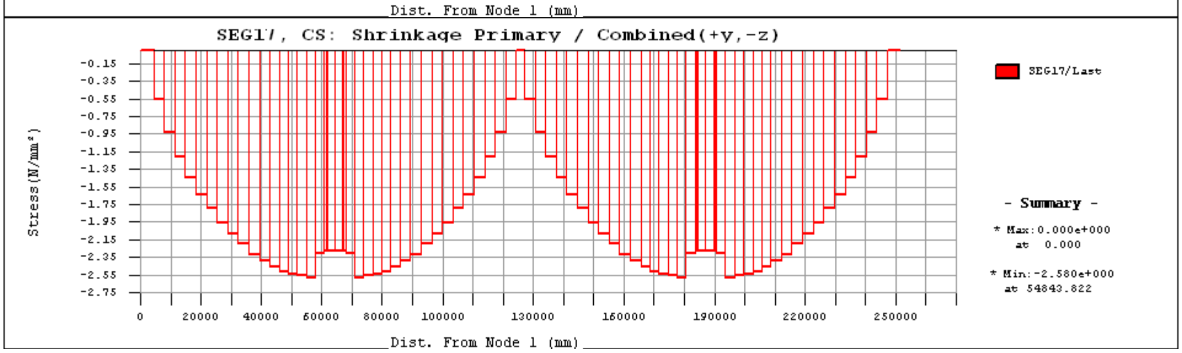

SEG17, CS: Erection Load / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -1.756e-002 at 205622.897

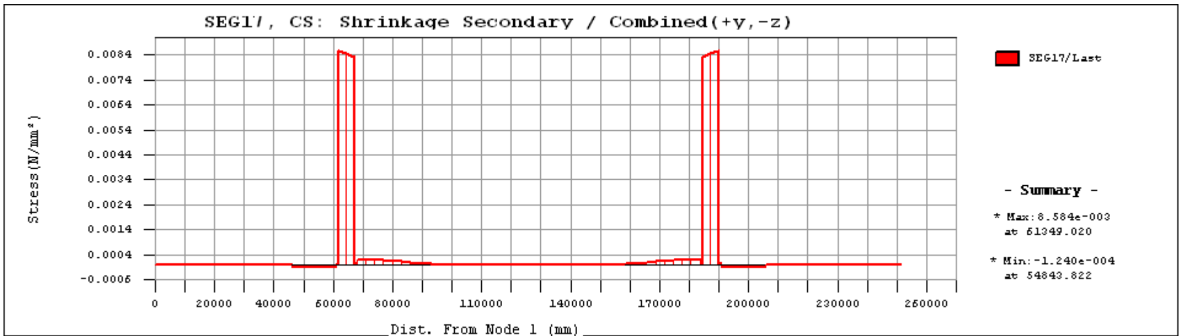

SEG17, CS: Tendon Primary / Combined(+y,-z)
SEG17/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 5.167e+000 at 168597.730
* Min: 0.000e+000 at 0.000


SEG17, CS: Tendon Secondary / Combined(+y,-z)
SEG17/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 5.000e-006 at 236647.687
* Min: -1.116e-001 at 67353.604

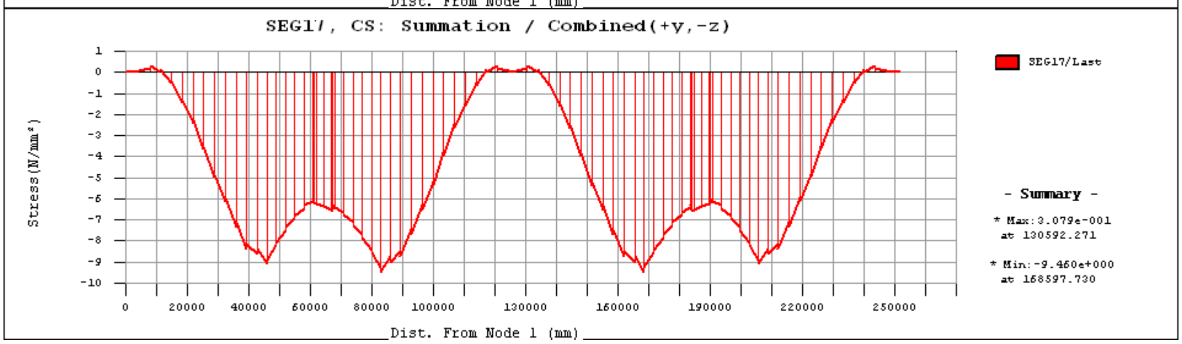

SEG17, CS: Creep Primary / Combined(+y,-z)
SEG17/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 1.305e-001 at 130592.271
* Min: -4.373e+000 at 168597.730


SEG17, CS: Creep Secondary / Combined(+y,-z)
SEG17/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 8.200e-005 at 82861.793
* Min: -4.009e-003 at 67353.604


SEG17, CS: Shrinkage Primary / Combined(+y,-z)
SEG17/Last
Stress(N/mm²)
Dist. From Node 1 (mm)
- Summary -
* Max: 0.000e+000 at 0.000
* Min: -2.580e+000 at 54843.822



SEG17, CS: Shrinkage Secondary / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max: 8.584e-003 at 61349.020
* Min: -1.240e-004 at 54843.822



SEG17, CS: Summation / Combined(+y,-z)
Stress(N/mm²)
Dist. From Node 1 (mm)
SEG17/Last
- Summary -
* Max: 3.079e-001 at 130592.271
* Min: -9.460e+000 at 168597.730

CS Load Cases (Construction stage analysis of MIDAS/Civil automatically generates the load cases noted in the table below.)

No.	Load Case	Result			
		Reaction	Deformation	Force	Stress
1	CS: Dead Load	O	O	O	O
2	CS: Erection Load	O	O	O	O
3	CS: Tendon Primary	O	O	O	O
4	CS: Tendon Secondary	O	X	O	O
5	CS: Creep Primary	O	O	O	O
6	CS: Creep Secondary	O	X	O	O
7	CS: Shrinkage Primary	O	O	O	O
8	CS: Shrinkage Secondary	O	X	O	O
9	CS: Summation	O	O	O	O
	load cases included in CS: Summation	1+2+4+6+8	1+2+3+5+7	1+2+3+4+6+8	1+2+3+4+6+8

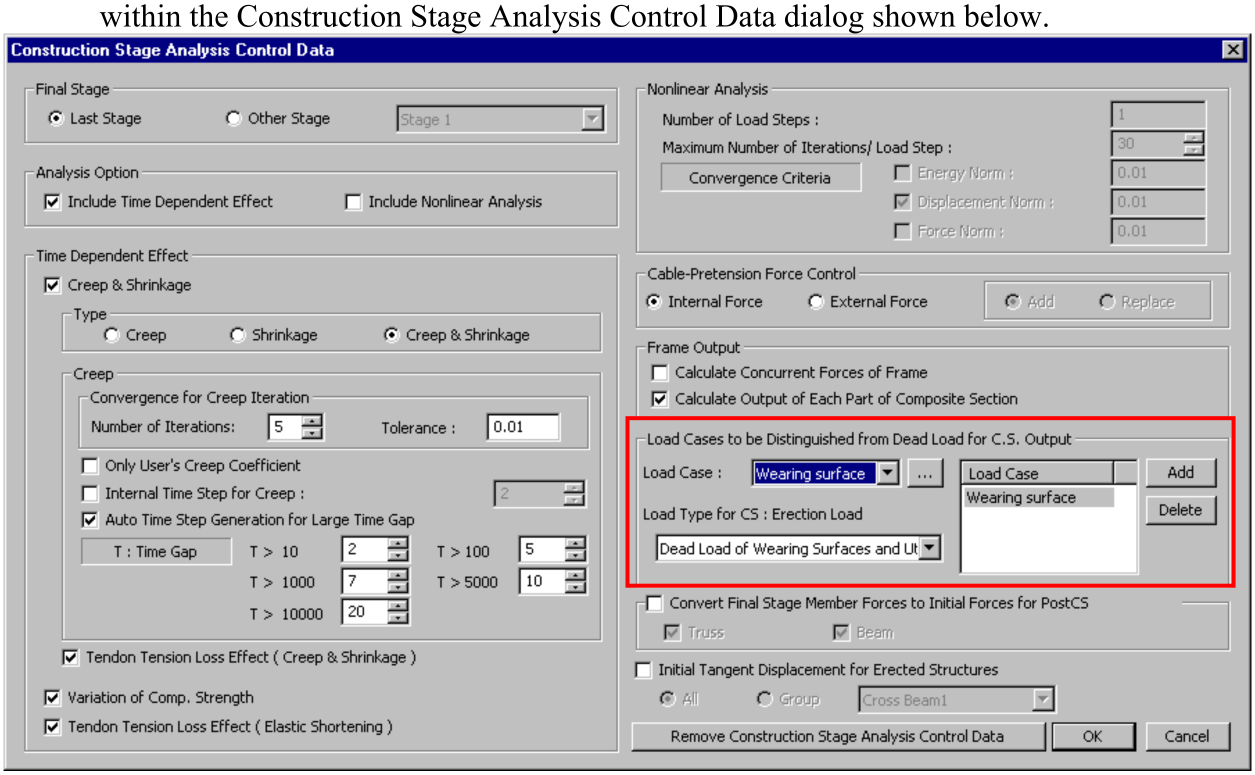
Legend: O - generated & X- not generated

CS: Dead Load

Dead Load represents the results due to all the load cases applied to the construction stages including the self-weight, excluding Erection Load and the effects of Tendon Prestress, Creep and Shrinkage.

CS: Erection Load

Erection Load represents the results due to all permanent loads applied to the construction stages in addition to Dead Load. Typically superimposed dead loads are included. The results of Erection Load are reported separately from Dead Load. Erection Load is specified in “Load Cases to be Distinguished from Dead Load for CS Output” within the Construction Stage Analysis Control Data dialog shown below.



CS: Tendon Primary (Due to idealization as a determinate structure)

Reactions: Results are of no significance (zero) and unaccounted for in CS Summation.

Deformations: Deformations due to Tendon Prestress loads (includes the secondary effect results)

Forces: Member forces induced by Tendon Prestress loads

Stresses: Member stresses induced by Tendon Prestress loads

CS: Tendon Secondary (Due to the effects of indeterminacy of actual constraints)

Reactions: Reactions due to Tendon Prestress loads

Forces: Member forces resulting from an indeterminate structure due to Tendon Prestress loads. Forces are zero for determinate structures.

Stresses: Stresses resulting from an indeterminate structure due to Tendon Prestress loads. Stresses are zero for determinate structures.

CS: Creep Primary

Reactions: Results are of no significance and unaccounted for in CS Summation.

Deformations: Deformations due to Creep (includes the secondary effect results)

Forces: Fictitious member forces required to cause the Creep strain, therefore, unaccounted for in CS Summation

Stresses: Fictitious stresses required to cause the Creep strain, therefore, unaccounted for in CS Summation

CS: Creep Secondary

Reactions: Reactions due to Creep resulting from the effects of support constraints

Forces: Member forces due to Creep resulting from the effects of support constraints

Stresses: Stresses due to Creep resulting from the effects of support constraints

CS: Shrinkage Primary

Reactions: Results are of no significance and unaccounted for in CS Summation.

Deformations: Deformations due to Shrinkage (includes the secondary effect results)

Forces: Fictitious member forces required to cause the Shrinkage strain, therefore, unaccounted for in CS Summation

Stresses: Fictitious stresses required to cause the Shrinkage strain, therefore, unaccounted for in CS Summation

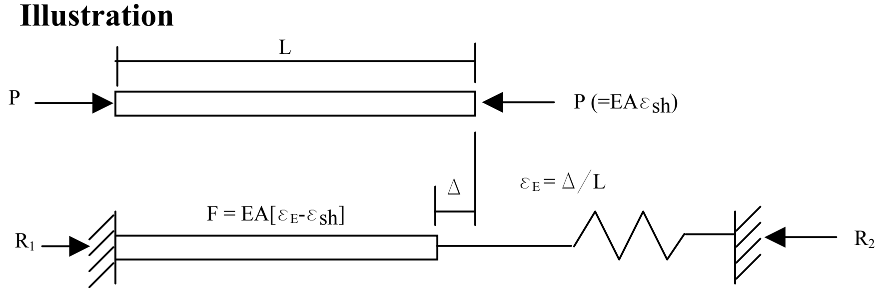
CS: Shrinkage Secondary

Reactions: Reactions due to Shrinkage resulting from the effects of support constraints

Forces: Member forces due to Shrinkage resulting from the effects of support constraints

Stresses: Stresses due to Shrinkage resulting from the effects of support constraints

Illustration



Spring represents the constraints of the member.

ε_{sh}: Shrinkage strain (time-dependent strain due to shrinkage)

P: Fictitious member force required to induce Shrinkage strain (CS: Shrinkage Primary)

Computing the fictitious force is necessary in the process of finding the shrinkage strain, which is expressed in terms of member forces. This however has no physical meaning.

Δ: Deformation due to Shrinkage accounting for the constraints (CS: Shrinkage Primary)

F: Member force due to Shrinkage accounting for the constraints (CS: Shrinkage Secondary)

R_1, R_2: Reactions due to Shrinkage accounting for the constraints (CS: Shrinkage Secondary)