Draft NATIONAL ANNEX TO SLS EN 1991-1-5:202x, ACTIONS ON STRUCTURES -PART 1-5: GENERAL ACTIONS -THERMAL ACTIONS

NA to SLS EN 1991-1-5:202x

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Draft NATIONAL ANNEX (INFORMATIVE) TO SLS EN 1991-1-5:202x, ACTIONS ON STRUCTURES -PART 1-5: GENERAL ACTIONS -THERMAL ACTIONS

INTRODUCTION

This National Annex has been prepared based on **EN 1991-1-5:2003+AC:2010** by the Working group on the development of the National Annexes to Euro Codes (SC35/WG/12). It is to be used in conjunction with **SLS EN 1991-1-5:2014,** along with any further revision, amendment or corrigendum thereto.

This National Annex was approved by the Sectoral Committee on Building and Construction Materials and was authorized for adoption and publication as a Sri Lanka National annex by the Council of the Sri Lanka Standards Institution on 2021-XX-XX.

In the preparation of this standard the assistance derived from the publication of the European Committee for Standardization (CEN) and British Standards Institution (BSI) is gratefully acknowledged.

NA.1 SCOPE

This National Annex gives:

a) the Sri Lanka decisions for the Nationally Determined Parameters described in the following sub clauses of **SLS EN 1991-1-5: 2014:**

- 5.3(2)	- 6.1.4.2(1)	- 7.2.1(1)P
- 6.1.1(1)	- 6.1.4.3(1)	- 7.5(3)
- 6.1.2(2)	- 6.1.4.4(1)	-7.5(4)
- 6.1.3.1(4)	- 6.1.5(1)	- A.1(1)
- 6.1.3.2(1)P	- 6.1.6(1)	-A.1(3)
-6.1.3.3(3)	- 6.2.1(1)P	-A.2(2)
- 6.1.4(3)	-6.2.2(1)	-B(l)
- 6.1.4.1(1)	- 6.2.2(2)	

b) the Sri Lanka decisions on the status of SLS EN 1991-1-5:2014 informative annexes C and D (see NA.3); and

c) references to non-contradictory complementary information.

NA.2 NATIONALLY DETERMINED PARAMETERS

Sri Lanka decisions for the Nationally Determined Parameters described in **SLS EN 1991-1-5:2014** are given in Table **NA 1**.

Table NA 1 – Sri Lanka values for Nationally Determined Parameters described in SLS EN 1991-1-5:2014

Sub clause	Nationally Determined Parameter	Sri Lanka decision
5.3(2)	Determination of temperature profiles	Refer isotherm maps Fig. 2.2 and Fig. 2.3 of RDA Bridge design manual for the time being. *The following values may be used as* *$T_1 = T_2 = 26°C$.* *The minimum shade air temperature T_{min} and the maximum shade air temperature T_{max} should be obtained from Figure NA.1 and Figure NA.2, respectively* *The following values shall be adopted for all conditions.* *$T_3 = 18°C$, $T_4 = 26°C$, and $T_5 = 34°C$* *T6 =24°C* *T7=21°C* *T8 and T9 are not applicable*
6.1.1, NOTE 2	Bridge deck types	**NA.2.2.1 General** Values for the uniform temperature component and temperature difference component for buried concrete box and portal frame structures, and masonry arch bridges with solid spandrels, are given in **NA.2.2.2 and NA.2.2.3.** Values for other types of bridges not covered in SLS EN 1991-1-5 should be agreed for the individual project with the relevant authority, where appropriate. The following may be considered to be protected from climatic and operational temperature changes: a) the walls and base slab of buried concrete box structures and the walls of buried concrete portal frame structures; b) in situ buried concrete structures which have over 0.6 metres of cover (fill plus surfacing) and which are more than five times as long (transversely) as the clear span or, for multi span structures, five times as long as the largest clear span; c) precast buried concrete segments which have over 0.6 metres of cover (fill plus surfacing) and which are located more than 1.25 times the clear span from the edge of the structure. Buried concrete box and portal frame structures, and masonry arch bridges with solid spandrels should be classified as Type 3 structures.

		NA.2.2.2 Uniform temperature component For buried concrete box and portal frame structures, and masonry arch bridges with solid spandrels, where the total cover depth from the top of the surfacing to the top of the roof slab or extrados of the arch ring is greater than 200 mm, the minimum and maximum uniform bridge temperatures obtained from SLS EN 1991-5:2014, Figure 6.1, and adjusted using Table NA.1 may be further modified as follows: For every additional 100 mm of total cover depth in excess of 200mm: a) the minimum uniform bridge temperature may be increased by 1°C; b) the maximum uniform bridge temperature may be reduced by 2°C. However, the difference between the maximum and minimum uniform bridge temperature should not be taken as less than 15°C. Changes in uniform bridge temperature may be ignored when the total depth from the top of the surfacing to the top of the roof slab or extrados of the arch ring is 1.5 m or greater.
		NA.2.2.3 Temperature difference component SLS EN 1991-5:2014, Annex B, should be used to establish temperature differences for buried concrete box and portal frame structures, and masonry arch bridges with solid spandrels. In SLS EN 1991-5:2014, Table B.3, the value of *h* for buried concrete structures should be taken as the distance from the underside of the surfacing to the soffit of the roof slab. For masonry arch bridges the value of *h* in Table **B.3** should be taken as the distance from the underside of the surfacing to the Intrados of the arch ring.
		In SLS EN 1991-5:2014, Figure **6.2a**, Figure **6.2b** and Figure **6.2c**, ΔT_1 should be taken as occurring at the underside of the surfacing and the dimensions *h* and h_1 should be measured downwards from that level so that the temperature profiles shown in SLS EN 1991-5:2014, Figure **6.2c**, are applied through the fill as well as through the roof slab or arch ring. Heating and cooling temperature differences may be ignored when the total depth from the top of the surfacing to the top of the roof slab or extrados of the arch ring exceeds 500 mm.

Table NA 1 – Sri Lanka values for Nationally Determined Parameters described in SLS EN 1991-1-5:2014 (Cont.)

<table>
<tr><th>Sub clause</th><th>Nationally Determined Parameter</th><th>Sri Lanka decision</th></tr>
<tr><td>6.1.2(2)</td><td>Consideration of thermal actions</td><td>Approach 2 should be used, unless the use of Approach 1 is agreed for the individual project with the relevant authority.</td></tr>
<tr><td>6.1.3.1(4)</td><td>Uniform temperature components-General</td><td>The values of $T_{e.min}$ and $T_{e.max}$ recommended in SLS EN 1991-1-5:2014, Figure 6.1, should be used, subject to the adjustments for deck surfacing given in Table NA.1.The uniform bridge temperature components are dependent on the depth of surfacing on the bridge deck, and the values given in SLS EN 1991-1-5:2014, Figure 6.1, assume depths of 40 mm for Type 1 and 100 mm for Types 2 and 3. When the depth of surfacing differs from these values, the minimum and maximum uniform bridge temperature components should be adjusted by the amounts given in Table NA.1.
Table NA.1 Adjustment to uniform bridge temperature for deck surfacing
<table>
<tr><th rowspan="2">Deck surface</th><th colspan="3">Addition to minimum uniform bridge temperature component, °C</th><th colspan="3">Addition to maximum uniform bridge temperature component, °C</th></tr>
<tr><td>Type 1</td><td>Type 2</td><td>Type 3</td><td>Type 1</td><td>Type 2</td><td>Type 3</td></tr>
<tr><td>Unsurfaced</td><td>0</td><td>-3</td><td>-1</td><td>+4 C)</td><td>0</td><td>0</td></tr>
<tr><td>Water-proofed A)</td><td>0</td><td>-3</td><td>-1</td><td>+4 C)</td><td>+4</td><td>+2</td></tr>
<tr><td>40 mm surfacing B)</td><td>0</td><td>-2</td><td>-1</td><td>0</td><td>+2</td><td>+1</td></tr>
<tr><td>100 mm surfacing B)</td><td>N/A</td><td>0</td><td>0</td><td>N/A</td><td>0</td><td>0</td></tr>
<tr><td>200 mm surfacing B)</td><td>N/A</td><td>+3</td><td>+1</td><td>N/A</td><td>-4</td><td>-2</td></tr>
</table>
A) Waterproofed deck values are conservative, assuming dark material; there may be some alleviation when light coloured Waterproofing is used; specialist advice should be sought if required.
B) Surfacing depths include waterproof mg.
C) For steel truss and plate girders the values for unsurfaced and waterproofed deck surfaces may be reduced to +2 °C</td></tr>
<tr><td>6.1.3.2(1)</td><td>Shade air temperature</td><td>The minimum and maximum shade air temperatures with a probability of being exceeded of 0.02 (1 in 50 year return period) should be obtained from the maps of isotherms in Figure NA.1 and Figure NA.2, respectively.
(Source: RDA Bridge Design Manual,1997)</td></tr>
</table>

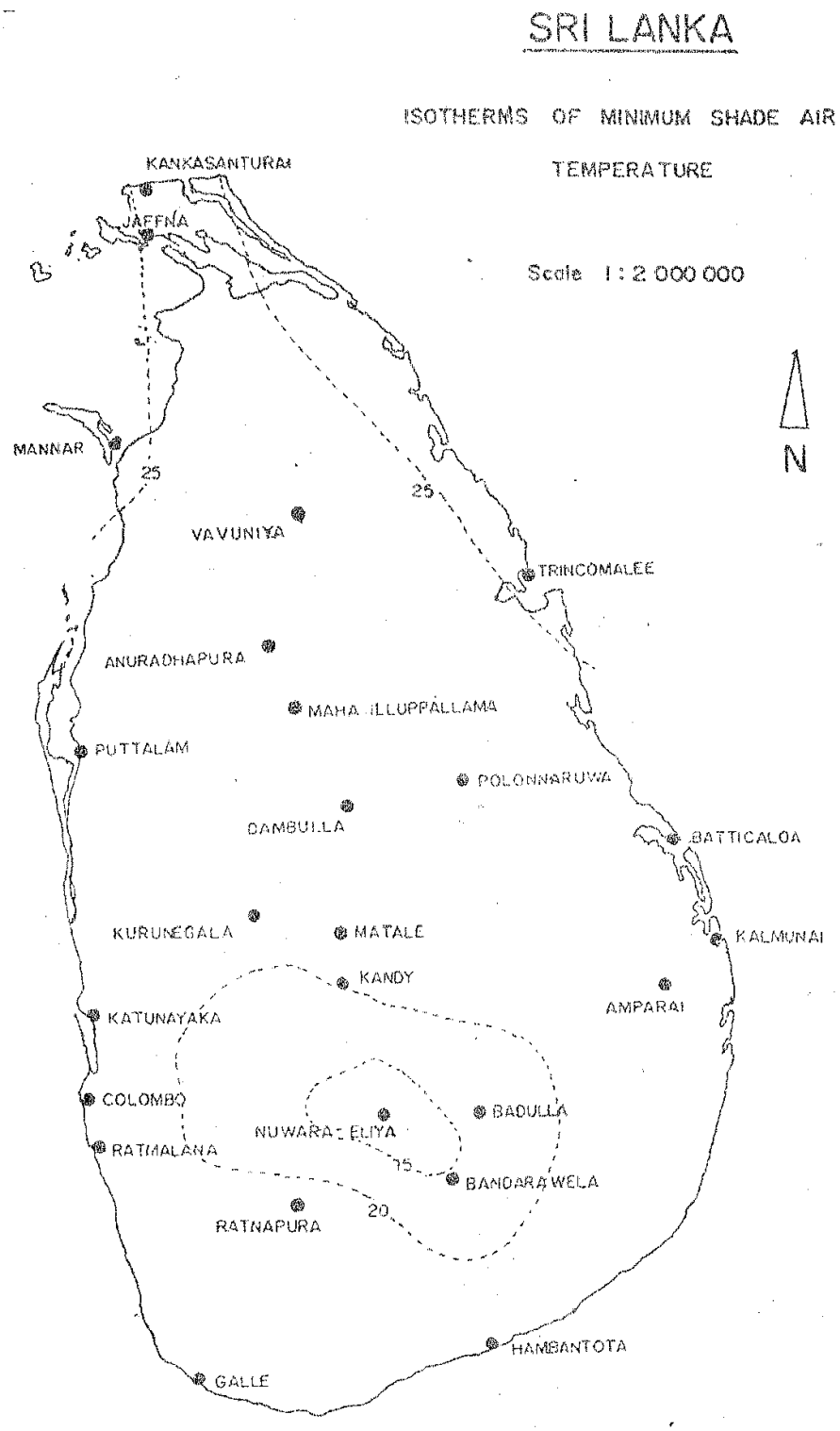

FIGURE NA.1: Isotherms of Shade Minimum in ^{0} C

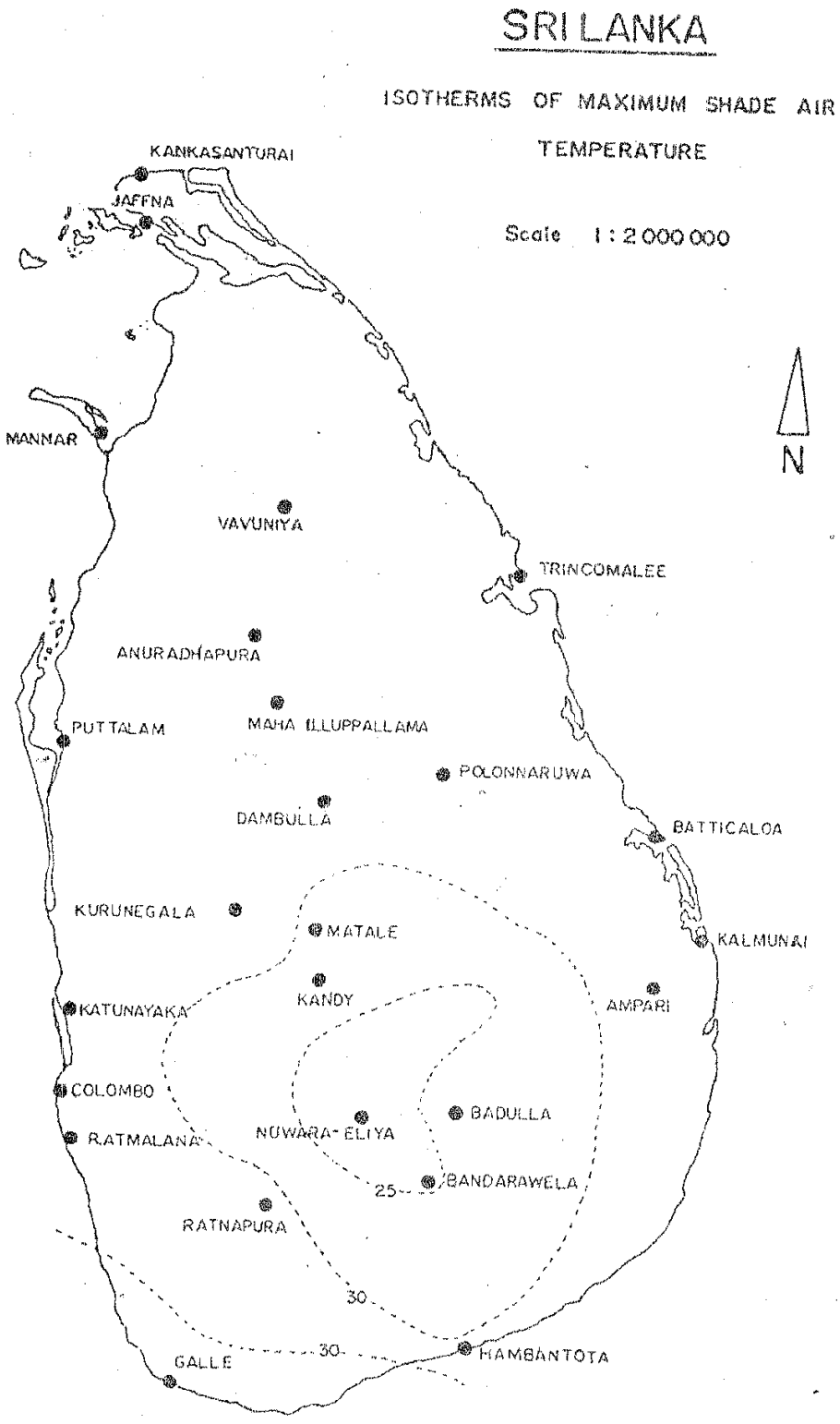

FIGURE NA.2: Isotherms of Shade Maximum in ^{0} C

Table NA 1 – Sri Lanka values for Nationally Determined Parameters described in SLS EN 1991-1-5:2014 (Cont.)

Sub clause	Nationally Determined Parameter	Sri Lanka decision
6.1.3.3(3)	**Range of uniform bridge temperature component**	For bearings and expansion joints, the maximum expansion and contraction ranges of the uniform bridge temperature component should be as given by other relevant standards (for example, SLSEN 1993-2). Where no information is given the requirements should be as follows: ($\Delta T_{N, exp}$ + 15) °C and ($\Delta T_{N, con}$ + 15) °C, respectively. If the temperature at which the bearings and expansion joints are set is specified, then the ranges are ($\Delta T_{N, exp}$ + 7) °C and ($\Delta T_{N, con}$ + 7) °C, respectively.
6.1.4(3)	**Temperature difference components**	The initial temperature difference at the closure of cantilever construction should be specified for the individual project.
6.1.4.1(1)	**Vertical linear component (Approach 1)**	Generally, Approach 1 should not be used. However, where Approach 1 is specified and permitted for use, the values of $\Delta T_{M, heat}$ and $\Delta T_{M, cool}$ and factor k_{sur} given in SLS EN 1991-1-5:2014, Table 6.1 and Table 6.2, respectively, should be used.
6.1.4.2(1)	**Vertical temperature components with non-linear effects (Approach 2)**	The temperature difference values recommended in SLS EN 1991-1-5:2014, Figure 6.2a to Figure 6.2c, for the different types of bridge deck should be used, but with the following changes to Figure 6.2a and Figure 6.2c: **In Figure 6.2a:** • In note, ΔT_N should be ΔT_u **In Figure 6.2c:** Column (a) Heating: Table: the value of ΔT_1 for h ≥ 0.8 should be 13.5 instead of 13.0; Column (b) Cooling: Figure: the top horizontal line for h_3 should be lowered to the kink; • Column (b) Cooling: Below figure: line2: ≤ 0.20 m instead of ≥ 0.20 m;
6.1.4.3(1)	**Horizontal components**	For Sri Lanka Horizontal temperature difference between the outer edges of the bridge is insignificant.

Table NA 1 – Sri Lanka values for Nationally Determined Parameters described in SLS EN 1991-1-5:2014 (Cont.)

Sub clause	Nationally Determined Parameter	Sri Lanka decision
6.1.4.4(1)	**Temperature difference components within walls of concrete box girders**	The temperature difference is insignificant If deemed required, the temperature difference may be specified for an individual project
6.1.5(1)	**Simultaneity of uniform and temperature difference components**	Use the Euro code recommendation
6.1.6(1)	**Difference in the uniform temperature components between different structural elements**	Where relevant, the values for the differences in the uniform temperature component recommended in the note to SLS EN 1991-1-5:2014, 6.1.6(1), may be used. Alternatively, appropriate values may be determined from first principles
6.2.1(1)P	**Consideration of thermal actions**	Use the Euro code recommendation
6.2.2(1) **6.2.2**	**Temperature differences**	Use Euro code recommendations.
7.2.1(1)	**Shade air temperature**	See Figure NA.1 and Figure NA.2
7.5(3)	**Values of temperature components (indicative values)**	use the Euro code recommendation
7.5(4)	**Values of temperature components (indicative values)**	use the Euro code recommendation
A.1(1)	**Isotherms of national minimum shade air temperatures - General**	See Figure NA.1
A.1(3)	**Isotherms of national minimum and maximum shade air temperatures - General**	See Figure NA.1 and Figure NA.2
B(l)	**Temperature differences for various surfacing depths**	use the Euro code recommendation

NA.3 DECISIONS ON THE STATUS OF SLS EN 1991-1-5:2014 INFORMATIVE ANNEXES C AND D

SLS EN 1991-1-5:2014, Informative Annexes C and D, may be used as informative annexes.

NA.4 BIBLIOGRAPHY

Standards publications

SLS EN 1990 *Eurocode – Basis of structural design*
SLS EN 1991 (all parts), *Eurocode 1 – Actions on structures*
SLS EN 1993-2, *Eurocode 3 – Design of steel structures –Part 2: Steel bridges*