ICS 91.010.30

SR EN 1991-1-3/NA

September 2006

ROMANIAN STANDARD

Eurocode 1: Actions on structures - Part 1-3: General actions – Snow loads. National Annex

Eurocod 1: Acțiuni asupra structurilor- Partea 1-3: Acțiuni generale – Încărcări date de zăpadă. Anexă națională

Eurocode 1: Actions sur les structures - Partie 1-3: Actions générales – Charges de neige. Annexe Nationale

APPROVAL

Approved by the Director General of ASRO on 25 September 2006
Supersedes STAS 10101/21-92

ROMANIAN STANDARDS ASSOCIATION (ASRO)
21-25 Mendeleev Street, cod 010362, Bucharest ROMANIA
General Director: Phone: +40 21 316 32 96, Fax: +40 21 316 08 70
Director of Standardization Division: Phone: +40 21 310 17 30, +40 21 310 43 08, +40 21 312 47 44, Fax: +40 21 315 58 70
Sales Department – Subscriptions Department: Phone: +40 21 316 77 25, Fax + 40 21 317 25 14, +40 21 312 94 88
Marketing Editorial Staff-Copyright Department: Phone: + 40 21 316.99.74

Foreword

SR EN 1991-1-3:2005/NA:2006 is the National Annex NA which defines the conditions of application for SR EN 1991-1-3:2005 in Romania.

This National Annex has been prepared by the Technical Committee CT 343 “Basis of Design and Structural Eurocodes” of ASRO, the Secretariat of which is held by INCERC (National Institute for Building Research), under the authority of the Ministry of Transports, Constructions and Tourism.

This National Annex:

- provides Nationally Determined Parameters (NDP) for the following clauses of the European Standard EN 1991-1-3:2004, which allows the national choice for:
- 1.1(2), 1.1(3), 1.1(4)
- 2(3), 2(4)
- 3.3(1), 3.3(3)
- 4.1(1), 4.1(2), 4.2(1), 4.3(1)
- 5.2(2), 5.2(5), 5.2(6), 5.2(7), 5.2(8), 5.3.3(4), 5.3.4(3), 5.3.4(4), 5.3.5(1), 5.3.5(3), 5.3.6(1), 5.3.6(3)
- 6.2(2), 6.3(1), 6.3(2)
- A(1) (through Table A.1)

- defines conditions of application for the SR EN 1991-1-3:2005 Annexes, classified as normative -Annexes A and B- and informative - Annexes C, D and E

- presents the Romanian snow map of characteristic snow load on the ground referred to mean recurrence interval equal to 50 years

- presents, in a table format, the characteristic values of snow load on the ground referred to mean recurrence interval equal to 50 years for the most important locations in Romania

- defines conditions of application of SR EN 1991-1-3:2005 for sites at altitudes above 1500 m

Values of snow load partial factors for different design situations are given in SR EN 1990:2004 and its National Annex.

This National Annex plays a double role:

- on European level, based on CEN regulations, as an informative annex of EN 1991-1-3:2004, published by ASRO as the Romanian Standard SR EN 1991-1-3:2005 and

- on national level, as a distinct standard SR EN 1991-1-3:2005/NA:2006, which contains information on Nationally Determined Parameters to be used to determine snow load values in accordance with the Romanian Standard SR EN 1991-1-3 :2005.

The Romanian Standards SR EN 1991-1-3:2005/NA:2006, SR EN 1991-1-3:2005 and SR EN 1990:2004 with its National Annex and the Eurocodes EN 1991 to EN 1999 with their National Annexes should be used, the last after their national endorsement and implementation, to determine actions from snow for structural design and assessment of buildings and civil engineering works.

SR EN 1991-1-3:2005/NA:2006 and SR EN 1991-1-3:2005 supersede STAS 10101/21-92 « Actions on structures. Snow loads » by January 2010, at the latest. This date represents the deadline for the national endorsement and implementation of EN 1991 to EN 1999 with their National Annexes as well as the date by which any conflicting National Standards shall be withdrawn.

For the purpose of this national standard, the clause numbers had given in SR EN 1991-1-3:2005 apply.

I. Nationally Determined Parameters for SR EN 1991-1-3:2005

Section 1

1.1 Scope

(2) NOTE 1 - Advice for the treatment of snow loads for altitudes above 1 500 m may be found in the National Annex.

For sites at altitudes above 1 500 m, the characteristic values of ground snow loads shall be determined as follows:

$$s_k = 1.5 + 0.00602(A - 1000) \quad \text{for} \quad \text{Zone 1: } s_k\text{=1.5 kN/m}^2 \qquad (1)$$

$$s_k = 2.0 + 0.00560(A - 1000) \quad \text{for} \quad \text{Zone 2: } s_k\text{=2.0 kN/m}^2 \qquad (2)$$

where:

s_k is the characteristic snow load on the ground with an annual probability of exceedence of 0.02, [kN/m^2];
A is the site altitude above Sea Level [m].

The characteristic values of snow load on the ground shall be determined in accordance with SR EN 1991-1-3:2005, 4.1(1) Note 1, the Romanian snow load map, as shown in Figure NA.1, and the characteristic values of snow load for the most important towns and cities in Romania, as given in Table NA.1.

For particular buildings and civil engineering works located on sites at altitudes above 1 500 m, the snow load on the ground may be determined based on special studies, using statistical methods, of at least 20 year long daily records taken on the site.

1.1 Scope

(3) NOTE: These different locations may be identified by the National Annex.

The design situations and snow load arrangements indicated in SR EN 1991-1-3:2005, Annex A for normal and exceptional load conditions shall be used for all locations.

For particular buildings and civil engineering works, located at sites where exceptional snow falls for long periods of time have been recorded, the snow load on the ground may be determined based on special studies depending on local conditions.

1.1 Scope

(4) NOTE: The use of Annex B is allowed through the National Annex.

The snow load shape coefficients for exceptional snow drifts shall be used for all types of roofs presented in Annex B and for all snow load arrangements where drifted snow is deposited on the roof, only where indicated in Figures B1, B2, B3 and B4.

For exceptional snow drift loads, it should be assumed that snow load acts locally and that there is no snow elsewhere on the roof (see SR EN 1991-1-3:2005, Annex B, B1 (2)).

SR EN 1991-1-3:2005, Annex B applies to specific locations where all the snow usually melts and clears between the individual weather systems and where moderate to high wind speeds occur during the individual weather system.

Zone N°	Characteristic snow load for altitudes A≤1000m [kN/m^2]	Characteristic snow load for altitudes A>1000m [kN/m^2]
1	1.5	$s_k = 1.5 + 0.00602(A - 1000)$
2	2.0	$s_k = 2.0 + 0.00560(A - 1000)$
3	2.5	-

Figure NA.1 – Romanian snow map of characteristic snow load on the ground referred to mean recurrence interval equal to 50 years

Table NA.1 - Characteristic values of snow load on the ground referred to mean recurrence interval equal to 50 years for the most important locations in Romania

N°	Location	County	Zone N°
1	Abrud	ALBA	1
2	Adamclisi	CONSTANȚA	1
3	Adjud	VRANCEA	3
4	Agnita	SIBIU	1
5	Aiud	ALBA	1
6	ALBA IULIA	ALBA	1
7	Aleşd	BIHOR	1
8	ALEXANDRIA	TELEORMAN	3
9	Anina	CARAŞ-SEVERIN	2
10	Apa Neagră	GOROJ	2
11	ARAD	ARAD	1
12	Avrămeni	BOTOŞANI	2
13	Avrig	SIBIU	2
14	Azuga	PRAHOVA	2
15	Babadag	TULCEA	2
16	BACĂU	BACĂU	3
17	Baia de Aramă	MEHEDINȚI	2
18	BAIA MARE	MARAMUREŞ	2
19	Baia Sprie	MARAMUREŞ	2
20	Balinteşti	VASLUI	2
21	Balş	DOLJ	2
22	Banloc	TIMIŞ	1
23	Baraolt	COVASNA	2
24	Basarabi	CONSTANȚA	2
25	Băicoi	PRAHOVA	2
26	Băile Govora	VÂLCEA	2
27	Băile Herculane	CARAŞ-SEVERIN	2
28	Băile Olăneşti	VÂLCEA	2
29	Băile Tuşnad	HARGHITA	2
30	Băileşti	DOLJ	2
31	Băişoara	CLUJ	1
32	Bâcleş	MEHEDINȚI	2
33	Bârlad	VASLUI	2
34	Bechet	OLT	2
35	Beclean	BISTRIȚA	1
36	Beiuş	BIHOR	1
37	Bereşti	GALAȚI	2
38	Bicaz	NEAMȚ	2
39	BISTRIȚA	BISTRIȚA	1
40	Blaj	ALBA	1
41	Bocşa	CARAŞ-SEVERIN	1
42	Boldeşti-Scăeni	PRAHOVA	1
43	Boiţa	SIBIU	2
44	Borod	BIHOR	1
45	Borsec	HARGHITA	2
46	Borşa	MARAMUREŞ	2
47	BOTOŞANI	BOTOŞANI	3
48	Brad	HUNEDOARA	1
49	BRAŞOV	BRAŞOV	2
50	BRĂILA	BRĂILA	3
51	Breaza	PRAHOVA	2
52	Brezoi	VÂLCEA	2
53	BUCUREŞTI	BUCUREŞTI	2
54	Budeşti	CĂLĂRAŞI	3
55	BUFTEA	ILFOV	2
56	Buhuşi	BACĂU	2
57	Buşteni	PRAHOVA	2
58	BUZĂU	BUZĂU	2
59	Buziaş	TIMIŞ	1
60	Calafat	DOLJ	3
61	Caracal	OLT	2
62	Caransebeş	CARAŞ-SEVERIN	2
63	Carei	SATU MARE	1
64	Cavnic	MARAMUREŞ	2
65	Călan	HUNEDOARA	2
66	CĂLĂRAŞI	CĂLĂRAŞI	3
67	Călimăneşti	VÂLCEA	2
68	Câmpia Turzii	CLUJ	1
69	Câmpeni	ALBA	1
70	Câmpina	PRAHOVA	2
71	Câmpulung	ARGEŞ	2
72	Câmpulung Mold.	SUCEAVA	2
73	Ceahlău	HARGHITA	2
74	Cehu Silvaniei	SĂLAJ	1
75	Cernavodă	CONSTANȚA	2
76	Chişineu-Criş	ARAD	1
77	Cisnădie	SIBIU	1
78	CLUJ-NAPOCA	CLUJ	1
79	Codlea	BRAŞOV	2
80	Comarnic	PRAHOVA	2
81	Comăneşti	BACĂU	2
82	CONSTANȚA	CONSTANȚA	2
83	Copşa Mică	SIBIU	1
84	Corabia	OLT	2
85	Corugea	CONSTANȚA	2
86	Costeşti	ARGEŞ	2
87	Cotnari	VRANCEA	3
88	Covasna	COVASNA	2
89	CRAIOVA	DOLJ	2
90	Cristuru Secuiesc	HARGHITA	1
91	Cugir	ALBA	1
92	Cuntu	CARAŞ SEVERIN	2
93	Curtea de Argeş	ARGEŞ	2
94	Curtici	ARAD	1
95	Darabani	BOTOŞANI	2
96	Dej	CLUJ	1
97	Deta	TIMIŞ	1
98	DEVA	HUNEDOARA	1
99	Dorohoi	BOTOŞANI	2
100	Drăgăşani	VÂLCEA	2
101	Drăgăneşti-Olt	OLT	2
102	DROBETA TURNU SEVERIN	MEHEDINȚI	2
103	Dumbrăveni	SIBIU	1
104	Eforie Nord	CONSTANȚA	2
105	Eforie Sud	CONSTANȚA	2
106	Făgăraş	BRAŞOV	1
107	Fălticeni	SUCEAVA	3
108	Făurei	BRĂILA	3
109	Feteşti	IALOMIȚA	3
110	Fieni	DÂMBOVIȚA	2
111	Filiaşi	DOLJ	2
112	FOCŞANI	VRANCEA	2
113	Fundata	BRAŞOV	2
114	Fundulea	CĂLĂRAŞI	3
115	GALAȚI	GALAȚI	3
116	Găeşti	DÂMBOVIȚA	2

(to be continued)

Table NA.1 - Characteristic values of snow load on the ground referred to mean recurrence interval equal to 50 years for the most important locations in Romania

(to be continued)

N°	Location	County	Zone N°
117	Gheorgheni	HARGHITA	2
118	Gherla	CLUJ	1
119	GIURGIU	GIURGIU	3
120	Gorgova	TULCEA	3
121	Griviţa	IALOMIŢA	3
122	Gurahonţ	ARAD	1
123	Gura Humorului	SUCEAVA	2
124	Haţeg	HUNEDOARA	2
125	Hârlău	IAŞI	3
126	Hârşova	CONSTANŢA	3
127	Holod	BIHOR	1
128	Horezu	GORJ	2
129	Huedin	CLUJ	1
130	Hunedoara	HUNEDOARA	2
131	Huşi	VASLUI	2
132	Ianca	BRĂILA	3
133	IAŞI	IAŞI	3
134	Iezer	MARAMUREŞ	2
135	Ineu	ARAD	1
136	Isaccea	TULCEA	3
137	Însurăţei	BRĂILA	3
138	Întorsura Buzăului	COVASNA	2
139	Jimbolia	TIMIŞ	1
140	Jibou	SĂLAJ	1
141	Joseni	HARGHITA	2
142	Jurilovca	TULCEA	2
143	Lăcăuţi	COVASNA	2
144	Lehliu Gară	CĂLĂRAŞI	3
145	Lipova	ARAD	1
146	Luduş	MUREŞ	1
147	Lugoj	TIMIŞ	1
148	Lupeni	HUNEDOARA	2
149	Mangalia	CONSTANŢA	1
150	Marghita	BIHOR	1
151	Măcin	TULCEA	3
152	Măicăneşti	VRANCEA	2
153	Mărăşeşti	VRANCEA	2
154	Mărculeşti	CĂLĂRAŞI	3
155	Medgidia	CONSTANŢA	2
156	Mediaş	SIBIU	1
157	MIERCUREA CIUC	HARGHITA	2
158	Mihăileşti	GIURGIU	2
159	Mizil	PRAHOVA	2
160	Moineşti	BACĂU	2
161	Moldova Nouă	CARAŞ-SEVERIN	2
162	Moneasa	ARAD	1
163	Moroeni	DÂMBOVIŢA	2
164	Motru	GORJ	2
165	Nădlac	ARAD	1
166	Năsăud	BISTRIŢA NĂSĂUD	1
167	Năvodari	CONSTANŢA	2
168	Negreşti	VASLUI	3
169	Negreşti Oaş	SATU MARE	2
169	Negru Vodă	CONSTANŢA	1
170	Novaci	GORJ	2
171	Ocna Mureş	ALBA	1
172	Ocna Sibiului	SIBIU	2
173	Ocna Şugatag	MARAMUREŞ	2
174	Ocnele Mari	VÂLCEA	2
175	Odobeşti	VRANCEA	2
176	Odorheiul Secuiesc	HARGHITA	2
177	Oltenița	CĂLĂRAŞI	3
178	Onceşti	BACĂU	3
179	Oneşti	NEAMŢ	2
180	ORADEA	BIHOR	1
181	Oravița	CARAŞ-SEVERIN	2
182	Orăştie	HUNEDOARA	1
183	Orşova	MEHEDINŢI	2
184	Oţelu Roşu	CARAŞ-SEVERIN	2
185	Panciu	VRANCEA	2
186	Paşcani	IAŞI	3
187	Parâng	HUNEDOARA	2
188	Păltiniş	SIBIU	2
189	Pătârlagele	BUZĂU	2
190	Păclişa	SIBIU	2
191	Păncota	ARAD	1
192	Petrila	HUNEDOARA	2
193	Petroşani	HUNEDOARA	2
194	PIATRA NEAMŢ	NEAMŢ	2
195	Piatra Olt	DOLJ	2
196	PITEŞTI	ARGEŞ	2
197	Plenița	DOLJ	2
198	PLOIEŞTI	PRAHOVA	2
199	Plopeni	PRAHOVA	2
200	Podul Iloaiei	IAŞI	3
201	Poiana Stampei	BISTRIŢA NĂSĂUD	2
202	Polovragi	GORJ	2
203	Predeal	BRAŞOV	2
204	Rarău	SUCEAVA	2
205	Rădăuţi	SUCEAVA	3
206	Răuseni	BOTOŞANI	2
207	Râmnicu Sărat	BUZĂU	2
208	RÂMNICU VÂLCEA	VÂLCEA	2
209	Râşnov	BRAŞOV	2
210	Reghin	MUREŞ	1
211	Reşiţa	CARAŞ-SEVERIN	2
212	Roman	IAŞI	3
213	Roşiorii de Vede	TELEORMAN	3

(to be continued)

Table NA.1 - Characteristic values of snow load on the ground referred to mean recurrence interval equal to 50 years for the most important locations in Romania

(end)

N°	Location	County	Zone N°
214	Rovinari	GORJ	2
215	Rupea	BRAŞOV	1
216	Salonta	BIHOR	1
217	SATU MARE	SATU MARE	1
218	Săcele	BRAŞOV	2
219	Săcuieni	BIHOR	1
220	Sărmaşu	MUREŞ	1
221	Săvârşin	ARAD	1
222	Săveni	IAŞI	2
223	Sângeorz Băi	BISTRIȚA NĂSĂUD	2
224	Sânnicolau Mare	TIMIŞ	1
225	Sebeş	ALBA	1
226	Segarcea	DOLJ	2
227	Semenic	CARAŞ-SEVERIN	2
228	SFÂNTU GHEORGHE	COVASNA	2
229	Sf. Gheorghe	TULCEA	2
230	SIBIU	SIBIU	1
231	Sighetul Marmației	MARAMUREŞ	2
232	Sighişoara	MUREŞ	1
233	Simeria	HUNEDOARA	1
234	Sinaia	PRAHOVA	2
235	Siret	SUCEAVA	3
236	Siret Dorohoi	BOTOŞANI	2
237	SLATINA	OLT	2
238	Slănic Moldova	BACĂU	2
239	Slănic Prahova	PRAHOVA	2
240	SLOBOZIA	IALOMIȚA	3
241	Solca	SUCEAVA	2
242	Sovata	MUREŞ	2
243	Stei	BIHOR	1
244	Stolnici	ARGEŞ	2
245	Strehaia	MEHEDINȚi	2
246	SUCEAVA	SUCEAVA	3
247	Sulina	TULCEA	3
248	Supuru de Jos	SATU MARE	1
249	Şimleul Silvaniei	SĂLAJ	1
250	TÂRGOVIŞTE	DÂMBOVIȚA	2
251	Târgu Bujor	GALAȚI	2
252	Târgu Cărbuneşti	GORJ	2
253	Târgu Frumos	IAŞI	3
254	TÂRGU JIU	GORJ	2
255	Târgu Lăpuş	MARAMUREŞ	2
256	Târgu Logreşti	GORJ	2
257	TÂRGU MUREŞ	MUREŞ	1
258	Târgu Ocna	BACĂU	2
259	Târgu Neamț	NEAMȚ	2
260	Târgu Secuiesc	COVASNA	2
261	Târnăveni	MUREŞ	1
262	Techirghiol	CONSTANȚA	2
263	Tecuci	GALAȚI	2
264	Titeşti	VÂLCEA	2
265	Titu	DÂMBOVIȚA	2
266	TIMIŞOARA	TIMIŞ	1
267	Toplița	HARGHITA	2
268	Topoloveni	ARGEŞ	2
269	Turnu Măgurele	TELEORMAN	3
270	TULCEA	TULCEA	2
271	Tulnici	FOCŞANI	2
272	Turda	CLUJ	1
273	Tuşnad	HARGHITA	2
274	Țarcu	CARAŞ SEVERIN	2
275	Țăndărei	IALOMIȚA	3
276	Țicleni	GORJ	2
277	Uricani	GORJ	2
278	Urlați	PRAHOVA	2
279	Urziceni	IALOMIȚA	3
280	Valea lui Mihai	SATU MARE	1
281	VASLUI	VASLUI	2
282	Vaşcău	BIHOR	1
283	Vatra Dornei	SUCEAVA	2
284	Vălenii de Munte	PRAHOVA	2
285	Vânju Mare	MEHEDINȚI	3
286	Victoria	BRAŞOV	2
287	Videle	TELEORMAN	2
288	Vişeu de Sus	MARAMUREŞ	2
289	Viziru	BRĂILA	3
290	Vlăhița	HARGHITA	2
291	Voineasa	VÂLCEA	2
292	Vulcani	HUNEDOARA	2
293	ZALĂU	SĂLAJ	1
294	Zărneşti	BRAŞOV	2
295	Zimnicea	TELEORMAN	3
296	Zlatna	ALBA	1

Section 2

2 Classification of actions

(3) NOTE: The National Annex may give the conditions of use (which may include geographical locations) of this clause.

For locations where exceptional snow falls may occur (special local conditions, exceptional snow fall records etc.), the snow loads shall be treated as accidental actions and shall be determined in accordance with SR EN 1991-1-3:2005, 4.3, 5.2 and Annex B.

2 Classification of actions

(4) NOTE: The National Annex may give the conditions of use (which may include geographical locations) of this clause.

For locations where exceptional snow falls may occur, the snow loads on the roof shall be treated as accidental actions and determined in accordance with SR EN 1991-1-3:2005, 4.3, 5.2 and Annex B.

For locations where the characteristic value of snow load on the ground is $s_k \geq 2.5$ kN/m^2 and/or sites at altitudes above 1 000 m, the roof should also be designed for exceptional loads from snow drifts treated as accidental actions.

For particular buildings and civil engineering works, alternative values of exceptional loads from snow drifts on the roof may be determined based on special studies of local site conditions and particular roof geometry.

Section 3

3.3 Exceptional conditions

(1) NOTE 2: The National Annex may define which design situation applies for a particular local effect described in Section 6.

For cases where exceptional snow falls may occur (see SR EN 1991-1-3:2005, 2(3)) but not exceptional snow drifts on the roof (see SR EN 1991-1-3:2005, 2(4)), the design situations specified in SR EN 1991-1-3:2005, 3.3(1) (a) and 3.3(1) (b) should be used for local verifications of roof types presented in SR EN 1991-1-3:2005, section 6.

For local verifications of roofs with projections and obstructions, the exceptional snow load conditions on the roof should be considered in accordance with SR EN 1991-1-3:2005, Annex B.

3.3 Exceptional conditions

(3) NOTE 2: The National Annex may define which design situation to apply for a particular local effect described in Section 6.

For cases where both exceptional snow falls (see SR EN 1991-1-3:2005, 2(3)) and exceptional snow drifts on the roof (see SR EN 1991-1-3:2005, 2(4)) may occur, the design situations specified in SR EN 1991-1-3:2005, 3.3(3) (a), 3.3(3) (b) and 3.3(3) (c) should be used for local verifications of roof types presented in SR EN 1991-1-3:2005, section 6.

For local verifications of roofs with projections and obstructions, the exceptional snow load conditions on the roof should be considered in accordance with SR EN 1991-1-3:2005, Annex B.

Section 4

4.1 Characteristic values

(1) NOTE 1: The National Annex specifies the characteristic values to be used. To cover unusual local conditions the National Annex may additionally allow the client and the relevant authority to agree upon a different characteristic value from that specified for an individual project.

The characteristic value of snow load on the ground is defined based on an annual probability of exceedence of 0.02 or, equivalently, on a mean recurrence interval (MRI) equal to 50 years (see SR EN 1991-1-3:2005, 1.6.1).

The characteristic values of snow load on the ground shall be determined in accordance with the Romanian snow load map, as shown in Figure NA.1, and the characteristic values of snow load on the ground for the most important locations in Romania, as given in Table NA.1.
The characteristic values of snow load on the ground have been determined based on annual maximum values of snow layer depth, recorded at 114 weather stations between 1930 and 2005, over a 20 to 70 year long period of time.

For the evaluation of characteristic values of snow load on the ground, the bulk weight density of snow was taken γ =2.0 kN/m^3.

For sites at altitudes below 1 000 m, the characteristic values of ground snow loads do not take into account the snow load variation with altitude and shall be determined as follows:

Zone 1: s_k=1.5 kN/m^2
Zone 2: s_k=2.0 kN/m^2
Zone 3: s_k=2.5 kN/m^2

For sites at altitudes between 1 000 m and 1 500 m, the characteristic values of ground snow loads shall be determined as follows:

$$s_k = 1.5 + 0.00602(A - 1000) \quad \text{for} \quad \text{Zone 1: } s_k\text{=1.5 kN/m}^2 \qquad (3)$$

$$s_k = 2.0 + 0.00560(A - 1000) \quad \text{for} \quad \text{Zone 2: } s_k\text{=2.0 kN/m}^2 \qquad (4)$$

where:

s_k is the characteristic value of the snow load on the ground with an annual probability of exceedence of 0.02, [kN/m^2];
A is the site altitude above Sea Level [m].

For sites at altitudes above 1 500 m, see 1.1(2) Note 1.

For particular buildings and local conditions, the characteristic values of snow load on the ground at all sites may be adjusted to correspond to an annual probability of exceedence different of 0.02 (see II. Conditions of application for Annex D).

For particular buildings and civil engineering works located on sites at altitudes between 1 000 m and 1 500 m, the snow load on the ground may determined using an appropriate statistical analysis of at least 20 year long daily records taken on the site.

4.1 Characteristic values

(1) NOTE 2: Annex C gives the European ground snow load map, resulting from studies commissioned by DGIII/D-3. The National Annex may make reference to this map in order to eliminate, or to reduce, inconsistencies occurring at borderlines between countries.

For sites located near Romanian borders, the characteristic values of snow load on the ground shown in Figure NA.1 have not been correlated yet with the characteristic values of snow load on the ground shown in the National snow maps of neighbouring countries (Bulgaria, Republic of Moldova, Serbia, Ukraine and Hungary).

4.1 Characteristic values

(2) NOTE 1: The National Annex may give further complementary guidance.

SR EN 1991-1-3:2005, 4.1.2 is applied in its entirety.

4.2 Other representative values

(1) NOTE: The values of ψ may be set by the National Annex of EN 1990:2002.The recommended values of the coefficients ψ_0, ψ_1 and ψ_2 for buildings are dependent upon the location of the site being considered and should be taken from EN 1990:2002, Table A1.1 or Table 4.1 below, in which the information relating to snow loads is identical.

The values of ψ factors for snow loads on buildings ψ_0, ψ_1 and ψ_2 which should be used (see SR EN 1991-1-3:2005, 4.1.3) are given Table NA.2.

Table NA.2 – Values of ψ factors for snow loads on buildings

Snow load	ψ_0	ψ_1	ψ_2
All sites	0.7	0.5	0.4

4.3 Treatment of exceptional snow loads on the ground

(1) NOTE: The coefficient C_{esl} may be set by the National Annex. The recommended value for C_{esl} is 2.0 (see also 2(3))

The value of C_{esl} for exceptional snow loads on the ground is 2.0.

Section 5

5.2 Load arrangements

(2) NOTE: The National Annex may specify the use of Annex B for the roof shapes described in 5.3.4, 5.3.6 and 6.2, and will normally apply to specific locations where all the snow usually melts and clears between the individual weather systems and where moderate to high wind speeds occur during the individual weather system.

For roof shapes presented in SR EN 1991-1-3:2005, 5.3.4, 5.3.6 and 6.2, the exceptional snow loads on the roof should be considered in accordance with SR EN 1991-1-3:2005, 3.3 and Annex B.

5.2 Load arrangements

(5) NOTE 2: Further guidance may be given in the National Annex.

The artificial removal or redistribution of snow on a roof shall not be taken into account for roof design.

5.2 Load arrangements

(6) NOTE: Further complementary guidance may be given in the National Annex.

For buildings located in regions with possible rainfalls on the snow and consecutive melting and freezing, where snow and ice can block the drainage system of the roof, the snow loads may be increased by using a bulk weight density of snow greater than $\gamma = 2.0$ kN/m^3 (see SR EN 1991-1-3:2005, Annex E, E(2)).

5.2 Load arrangements

(7) NOTE: The National Annex may give the values of C_e for different topographies. The recommended values are given in Table 5.1 below.

Values of C_e are specified in SR EN 1991-1-3:2005, Table 5.1 for three types of topographies: windswept, normal and sheltered.

5.2 Load arrangements

(8) NOTE 1: Based on the thermal insulating properties of the material and the shape of the construction work, the use of a reduced C_t value may be permitted through the National Annex.

For all types of roof shapes, the value of thermal coefficient C_t is 1,0.

For glass covered roofs where snow melting may occur caused by a loss in heat through the roof surface, a reduction of the thermal coefficient value may be used based on the regulatory and inspection authorities approval. The reduction of C_t and, consequently, the reduction of roof snow load depend on air temperature of the building inner environment produced by technological processes and thermal insulating properties of the construction materials to be used.

5.3 Roof shape coefficients

5.3.3 Pitched roofs

(4) NOTE: Based on local conditions, an alternative drifting load arrangement may be given in the National Annex.

For pitched roofs where snow is not prevented from sliding off the roof, the load arrangements from snow drifts which should be used (snow load shapes and snow load shape coefficients $\mu_1(\alpha_1)$ and $\mu_2(\alpha_2)$) are shown in SR EN 1991-1-3:2005, Figure 5.3, case (ii) and (iii) and Table 5.2.

For particular buildings and civil engineering works, alternative values of snow loads on the roof should be determined based on special investigations of local site conditions and particular roof geometry.

5.3.4 Multi-span roofs

(3) NOTE: Where permitted by the National Annex, Annex B may be used to determine the load case due to drifting.

For roof valleys of a multi-span roof where snow is not prevented from sliding off the roof, the load arrangement from exceptional snow drifts which should be used is shown in SR EN 1991-1-3:2005, Annex B, B2(1) to B2(5) and Figure B1.

For exceptional snow drift loads, it should be assumed that snow load acts locally and that there is no snow elsewhere on the roof (see SR EN 1991-1-3:2005, Annex B, B1.(2)).

5.3.4 Multi-span roofs

(4) NOTE: Guidance may be given in the National Annex.

For roof valleys of a multi-span roof where one or both sides of the valley have a slope greater than 60^o the snow load arrangement is shown in SR EN 1991-1-3:2005, Figure 5.4 case (ii) and snow load shape coefficients $\mu_1(\alpha_1)$, $\mu_1(\alpha_2)$ and $\mu_2(\bar{\alpha})$ with $\bar{\alpha}=(\alpha_1+\alpha_2)/2$ are $\mu_1(\alpha_1)=0$, $\mu_1(\alpha_2)=0$ and $\mu_2(\bar{\alpha})=1.6$.

5.3.5 Cylindrical roofs

(1) NOTE 1: The upper value of μ_3 may be specified in the National Annex. The recommended upper value for μ_3 is 2,0 (see Figure 5.5).

For cases where snow is not prevented from sliding off the roof, the upper value of μ_3 is 2.0.

For cases where snow is prevented from sliding off the roof by placing snow fences, the snow load shape coefficient should not be reduced below 0.8.

5.3.5 Cylindrical roofs

(3) NOTE: Based on local conditions an alternative drifting load arrangement may be given in the National Annex.

For cylindrical roofs where snow is not prevented from sliding off the roof, the load arrangement from snow drifts which should be used is shown in Figure 5.6, case (ii).

For particular buildings and civil engineering works, alternative arrangements of snow load on the roof should be determined based on special studies depending on local site conditions and particular roof geometry.

5.3.6 Roof abutting and close to taller construction works

(1) NOTE 1: The range for μ_w may be fixed in the National Annex. The recommended range is $0,8 \leq \mu_w \leq 4$.

The snow load shape coefficient due to wind μ_w should be determined so that $0,8 \leq \mu_w \leq 4.0$.

For a roof cantilevered out beyond the walls abutting to taller construction works the value of μ_w is 6.0.

5.3.6 Roof abutting and close to taller construction works

(1) NOTE 2: A restriction for l_s may be given in the National Annex. The recommended restriction is $5 \leq l_s \leq 15$ m.

The drift length on a roof abutting or close to taller construction works should be determined so that $5.0 \leq l_s \leq 15.0$ m.

5.3.6 Roof abutting and close to taller construction works

(3) NOTE: Where permitted by the National Annex, Annex B may be used to determine the load case due to drifting.

The load arrangement from exceptional snow drifts on a roof abutting and close to taller construction works which should be used (snow load shapes and snow load shape coefficients μ_1, μ_2 and μ_3) is shown in SR EN 1991-1-3:2005, Annex B, B3(1), Figure B2 and Table B1.

For exceptional snow drift loads, it should be assumed that snow load acts locally and that there is no snow elsewhere on the roof (see SR EN 1991-1-3:2005, Annex B, B1.(2)).

For exceptional snow drift loads on a roof abutting or close to taller construction works less than 1.5 m away, the load arrangement which should be used (snow load shapes and snow load shape coefficients μ_1, μ_2 and μ_3) is shown in SR EN 1991-1-3:2005, Annex B, B3(1) to B3(3), Figure B2 and Table B1.

The roof abutting or close to taller construction works should only be designed for the exceptional snow load from snow deposited on the roof surface, without taken into account the drifted snow deposited between the buildings.

Section 6

6.2 Drifting at projections and obstructions

(2) NOTE: Where permitted by the National Annex, Annex B may be used to determine the load case due to drifting.

For a roof with projections and obstructions, local verifications due to snow drifting should also be made for exceptional loading conditions in accordance with SR EN 1991-1-3:2005, 3.3 and Annex B.

For roofs with obstructions less than 1.0 m high, canopies projecting not more than 5.0 m from the face of the building and obstructions over 1.0 m high but not more than 2.0 m wide, the load arrangements from exceptional snow drifts which should be used (snow load shapes and snow load shape coefficients μ_1, μ_2 and μ_3) are shown in SR EN 1991-1-3:2005, Annex B, B4(1) to B4(2) and Figure B3.

For exceptional snow drift loads, it should be assumed that snow load acts locally and that there is no snow elsewhere on the roof (see SR EN 1991-1-3:2005, Annex B, B1.(2)).

For roof parapets the load arrangements from exceptional snow drifts which should be used (snow load shapes and snow load shape coefficients μ_1, μ_2 and μ_3) are shown in SR EN 1991-1-3:2005, Annex B, B4(3) to B4(2) and Figure B4.

6.3 Snow overhanging the edge of a roof

(1) NOTE: The National Annex may specify the conditions of use for this clause. It is recommended that the clause is used for sites above 800 meters above sea level.

The loads due to snow overhanging the edge of the roof should also be considered
(see SR EN 1991-1-3:2005, 6.3(2)).

6.3 Snow overhanging the edge of a roof

(2) NOTE: The values of k may be given in the National Annex. The recommended way for calculating k is as follows: $k = 3/d$, but $k \leq d\ \gamma$. Where d is the depth of the snow layer on the roof in meters (see Figure 6.2).

The value of coefficient k which takes into account the irregular shape of snow on the roof is 2.5 for all locations.

II. Conditions of application of the SR EN 1991-1-3:2005 Annexes

Annex A - Design situations and load arrangements to be used for different locations

Annex A remains normative for the purpose of SR EN 1991-1-3:2005 and its National Annex.

The design situations and load arrangements presented in Annex A for normal conditions (SR EN 1991-1-3:2005, 3.2) and exceptional conditions (SR EN 1991-1-3:2005, 3.2) shall be used for all locations.

(Table A.1) Note 1 - Exceptional conditions are defined according to the National Annex.

The exceptional conditions are as defined in SR EN 1991-1-3:2005, 3.3(1) to 3.3(3).

(Table A.1) Note 2 - For cases B1 and B3 the National Annex may define design situations which apply for the particular local effects described in section 6.

For a roof with projections and obstructions, local verifications due to snow drifting should also be made for exceptional loading conditions (see 6.2(2) Note).

Annex B - Snow load shape coefficients for exceptional snow drifts

Annex B remains normative for the purpose of SR EN 1991-1-3:2005 and its National Annex.

Annex C - European Ground Snow Load Maps

Annex C remains informative for the purpose of SR EN 1991-1-3:2005 and its National Annex.

For sites located near Romanian borders, the characteristic values of snow load on the ground shown in Figure NA.1 have not been correlated yet with the characteristic values of snow load on the ground shown in the National snow maps of neighbouring countries (Bulgaria, Republic of Moldova, Serbia, Ukraine and Hungary).

At the time this National Annex was endorsed, the national snow maps of these countries were not incorporated in EN 1991-1-3:2003, Annex C.

Annex D - Adjustment of the ground snow load according to return period

Annex D remains informative for the purpose of SR EN 1991-1-3:2005 and its National Annex.

For building and civil engineering work design in Romania, the characteristic values of snow load on the ground with an annual probability of exceedence of 0.02 or, equivalently, with a mean recurrence interval equal to 50 years, shall be determined based on a lognormal probability distribution of snow load on the ground.

Characteristic values of snow load on the ground corresponding to a different annual probability of exceedence should be determined by using a lognormal probability distribution of snow load on the ground.

The characteristic value of snow load on the ground with a mean recurrence interval of *n* years may be determined as follows:

$$s_n = e^{m_{\ln S} + K\sigma_{\ln S}} \approx m_S e^{K\sqrt{\ln(1+V_S^2)}} = s_k e^{(k-2.054)\sqrt{\ln(1+V_S^2)}} \qquad \text{(NA D.1)}$$

where:

s_n is the characteristic value of snow load on the ground with a mean recurrence interval $\overline{T} = n$ years;

S is the snow load on the ground (annual maximum values);

s_k is the characteristic value of snow load on the ground (with a return period of 50 years, in accordance with SR EN 1990:2004);

m_S is the mean value of snow load on the ground (annual maximum values) ;

V_S is the coefficient of variation of annual maximum snow load;

$P_{1an}(S > s_{\overline{T}}) = \frac{1}{\overline{T}}$ is the annual probability of exceedence of the snow load fractile $s_{\overline{T}}$;

K is a factor for snow load fractile evaluation $s_{\overline{T}}$ (snow load values with an annual probability of exceedence of $1/\overline{T}$) for a lognormal probability distribution of snow load on the ground (Table NA.D.1).

Table NA.D.1 –*K* factor values for fractile evaluation of snow load on the ground

N^o	*K* factor	Mean recurrence interval $\overline{T}$ (years)	Annual probability of exceedence $1/\overline{T}$
1	1.281	10	0,1
2	1.645	20	0,05
3	2.054	50	0,02
4	2.326	100	0,01

The recommended value of the coefficient of variation of annual maximum snow load is 0.5.
Expression (NA.D.1) is shown graphically in Figure NA.D.1.

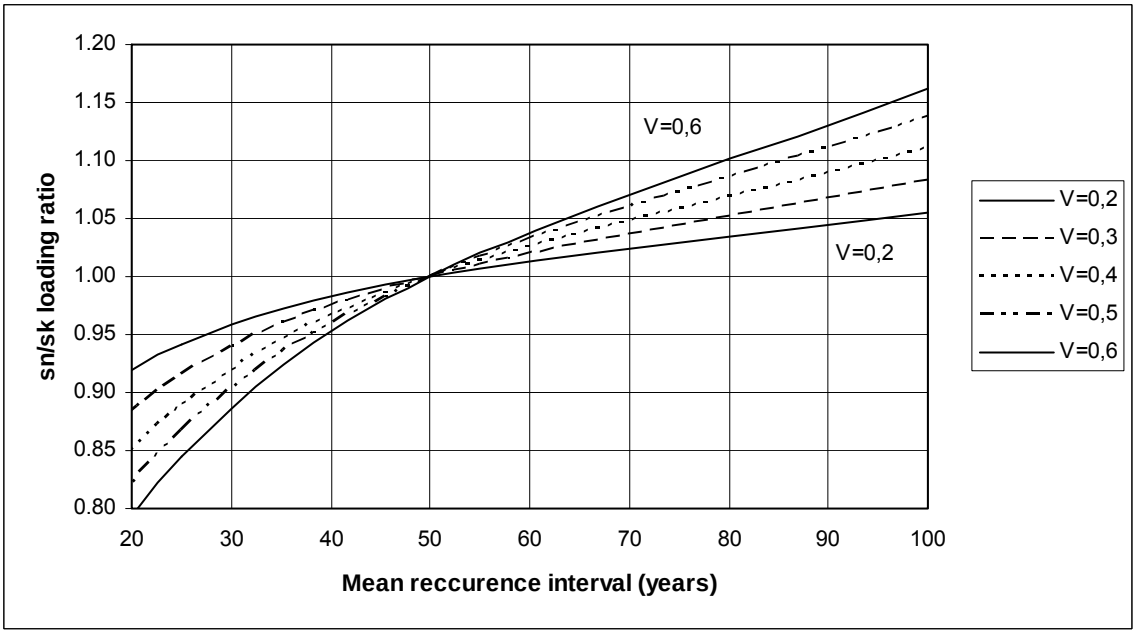

Figure NA.D.1 – Adjustment of the ground snow load according to return period

Annex E - Bulk weight density of snow

Annex E remains informative for the purpose of SR EN 1991-1-3:2005 and its National Annex.

Members of the Technical Committee TC 343 “Basis of Design and Structural Eurocodes” that participated in the development of this standard:

Chairman:	Mr.	Augustin	POPĂESCU	POPĂESCU SA
Secretary:	Mrs.	Anna-Maria	SCHIAU	INCERC – Bucharest
ASRO representative:	Mrs.	Marilena	CĂLIN	ASRO
Members:	Mr.	Dan	LUNGU	INCERC – Bucharest
	Mrs.	Dorina Nicolina	ISOPESCU	Technical University of Iassy
	Mr.	Dan	DUBINĂ	Polytechnical University of Timişoara
	Mr.	Mircea	MIRONESCU	MIRO GRUP
	Mr.	Dan	DUMITRESCU	SIGUR CONSTRUCT
	Mrs.	Liliana	CEAUŞU	C.N.S.I.P.C.
	Mr.	Constantin	CRISTESCU	ISPCF - Bucharest
	Mrs.	Doina	TOMA	MTCT-DRTC
	Mr.	Ioan	SONEA	M.A.I.
	Mr.	Florea	CRANGUS	CILAS - Braşov
	Mr.	Radu	PETROVICI	PROVEST INVEST- Bucharest
	Mr.	Şerban	DIMA	UTCB– Bucharest
	Mr.	Radu Ioan	PASCU	UTCB - Bucharest

The Romanian version of this standard has been prepared by Mrs. Mihaela BONTEA from INCERC Bucharest.