EUROCODES
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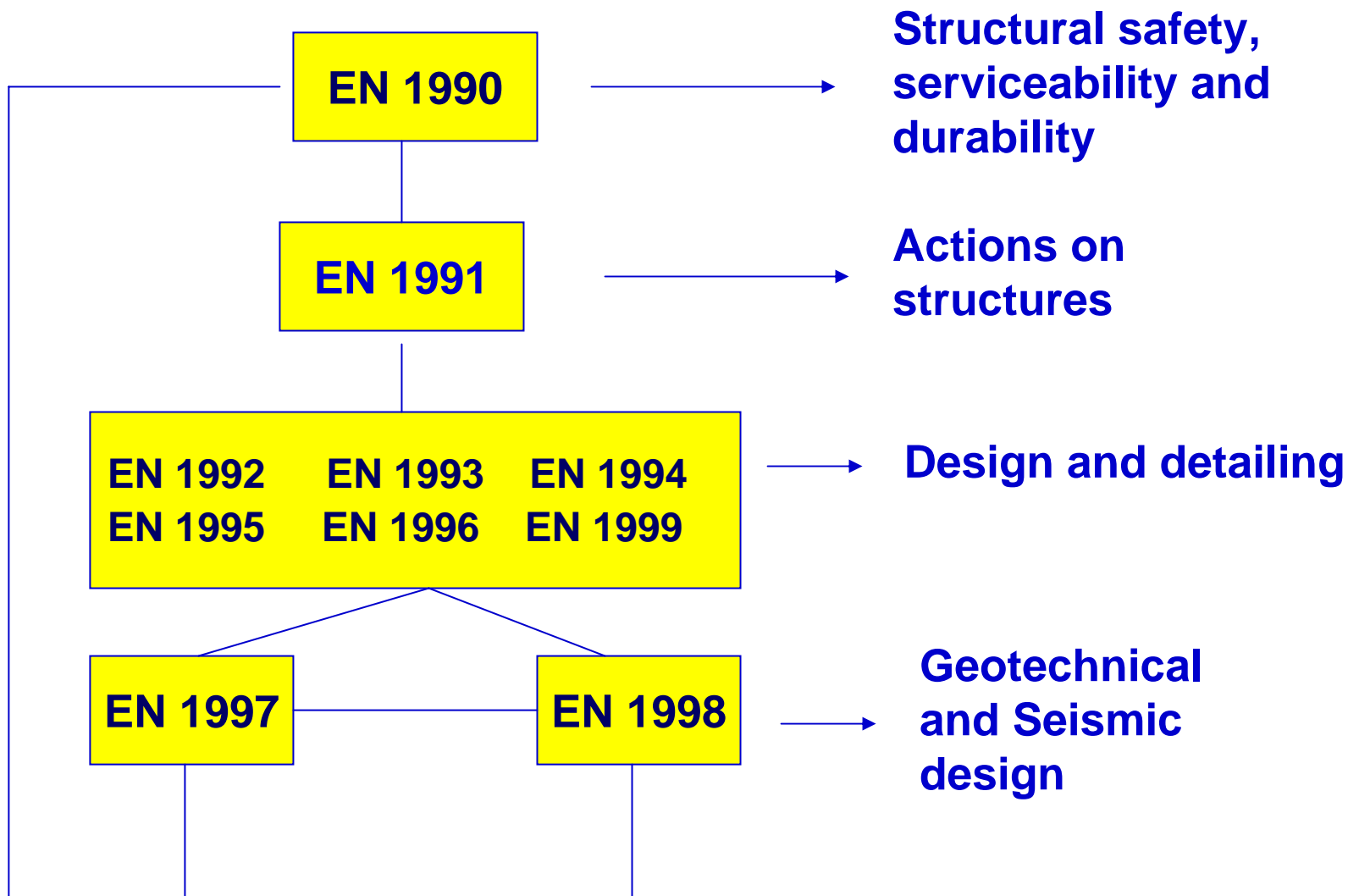
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# Introduction to EN 1991
# (Eurocode 1: Actions on structures)

**Dr-Ing. Nikolaos E. Malakatas**
Head of Department - Ministry of Environment,
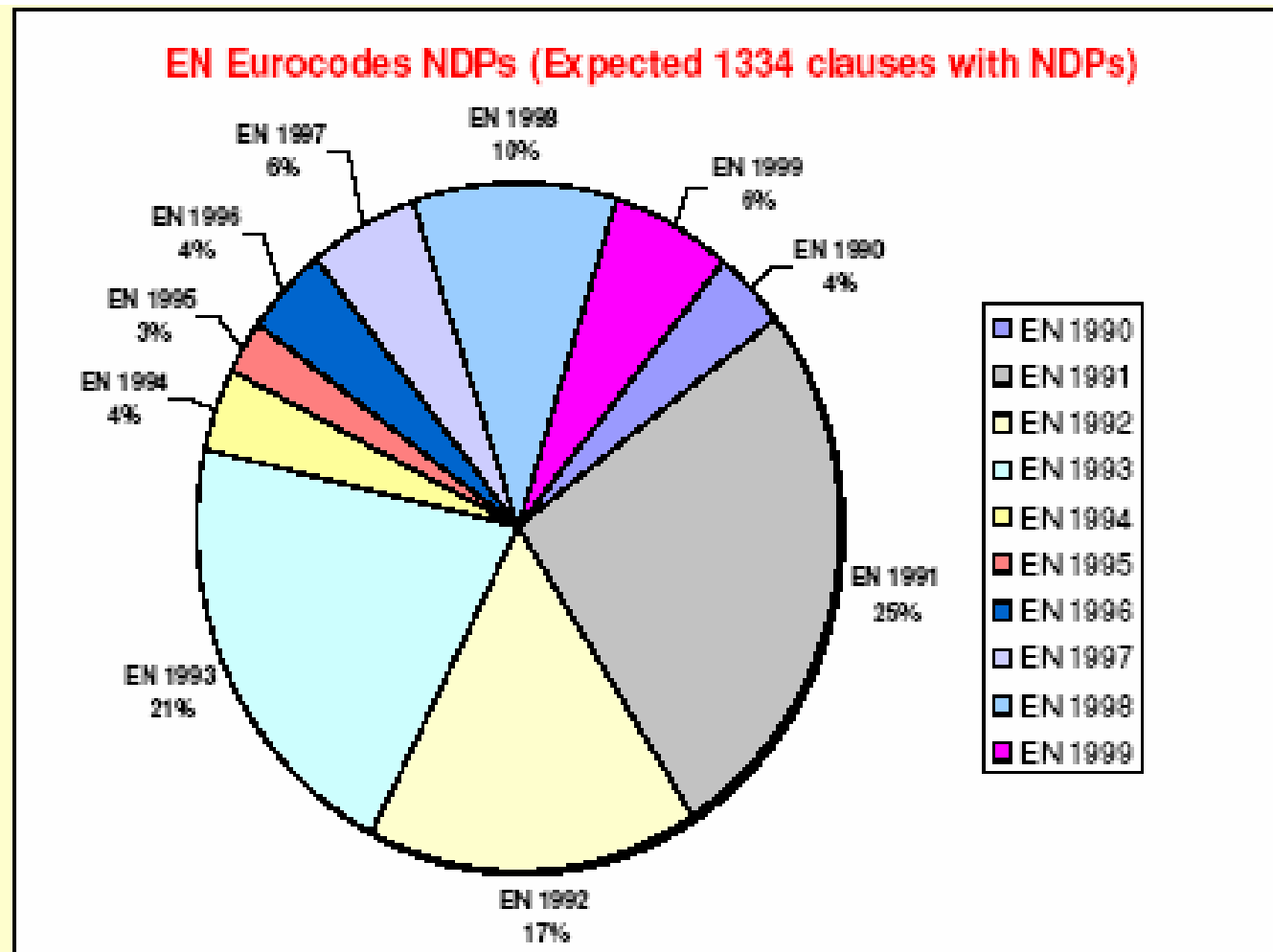Planning and Public Works - GREECE
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# LINKS BETWEEN THE EUROCODES

# Past and future of the EN 1991 (and the other Eurocodes)

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| Time Period | Phase | CEN/TC250 Chairman | CEN/TC250/SC1 Chairman |
|---|---|---|---|
| 1980′s | Technical preparation under EC Steering Committee | | |
| 1990 – 1998/2000 | ENV (under CEN) | Dr Breitschaft (until 1993) Dr Lazenby | Dr Menzies |
| 1998/2000 – 2007 | EN (under CEN) | Prof. Bossenmeyer | Prof. Gulvanessian |
| 2008 - ? | • Implementation<br>• Maintenance<br>• Harmonization<br>• Dissemination<br>• Further development | Prof. Calgaro | Dr Malakatas |

# Parts and implementation of EN 1991

| Part of Eurocode 1 : Actions on structures | Title (Subject) | Issued |
|---|---|---|
| EN 1991-1-1 | General actions – Densities, self-weight, imposed loads for buildings | April 2002 |
| EN 1991-1-2 | General actions – Actions on structures exposed to fire | November 2002 |
| EN 1991-1-3 | General actions – Snow loads | July 2003 |
| EN 1991-1-4 | General actions – Wind actions | April 2005 |
| EN 1991-1-5 | General actions – Thermal actions | November 2003 |
| EN 1991-1-6 | General actions – Actions during execution | June 2005 |
| EN 1991-1-7 | General actions – Accidental actions | July 2006 |
| EN 1991-2 | Traffic loads on bridges | September 2003 |
| EN 1991-3 | Actions induced by cranes and machinery | July 2006 |
| EN 1991-4 | Silos and tanks | May 2006 |

EN Eurocodes NDPs (Expected 1334 clauses with NDPs)

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# Types of NDPs in the Eurocodes

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Type 1: Value (s) of (a) parameter (s).

Type 2: Reference to some set of values – table (s).

Type 3: Acceptance of the recommended procedure, choice of calculation approach, when alternatives are given, or introduction of a new procedure.

Type 4: Country specific data (geographical, climatic, etc.).

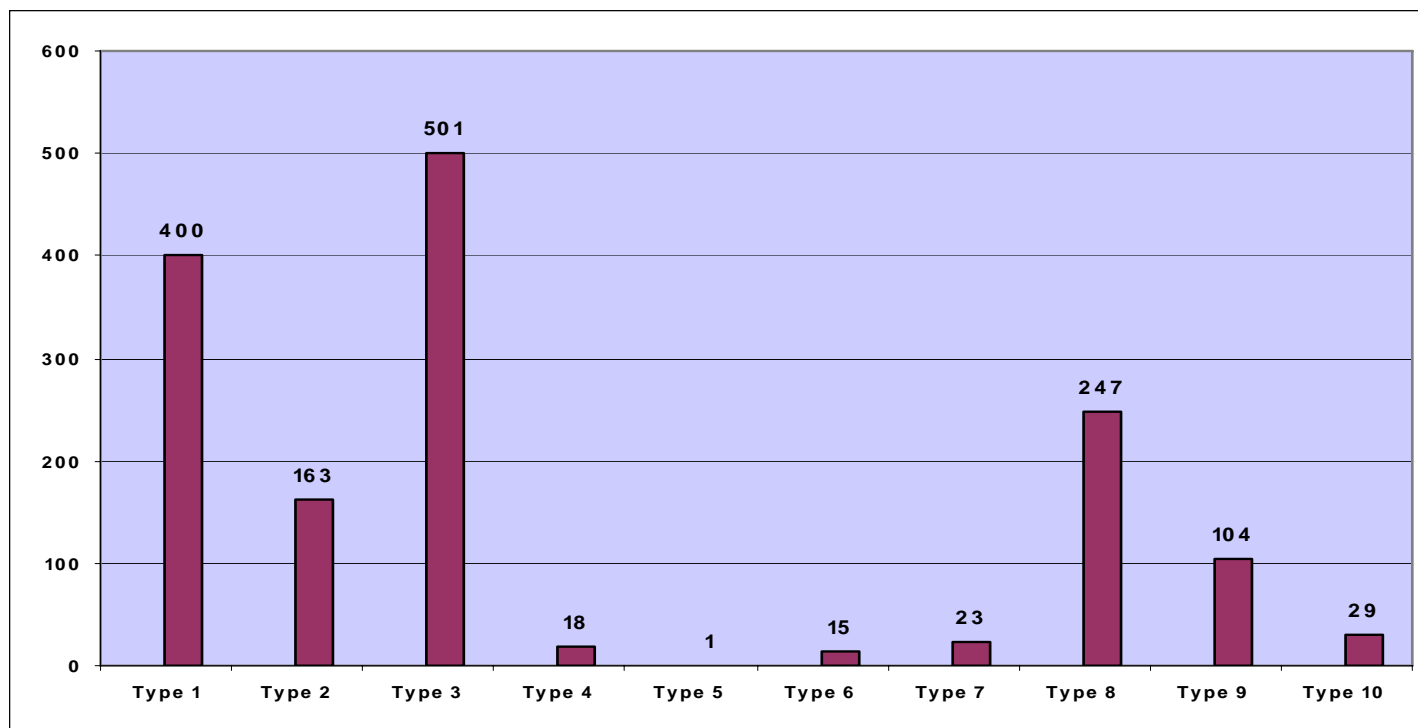Type 5: Optional National chart (s) or table (s) of a parameter.

Type 6: Diagram (s).

Type 7: References to non-contradictory complementary information to assist the user to apply the Eurocodes.

Type 8: Decisions on the application of informative annexes.

Type 9: Provision of further, more detailed information.

Type 10: Reference to information

- **Forward**
- **Section 1** – General
- **Section 2** – Classification of actions
- **Section 3** – Design situations
- **Section 4** – Densities of construction and stored materials
- **Section 5** – Self-weight of construction works
- **Section 6** – Imposed loads on buildings
- **Annex A (informative)** – Tables for nominal density of construction materials, and nominal density and angles of repose for stored materials.
- **Annex B (informative)** – Vehicle barriers and parapets for car parks

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# EN 1991-1-2: Actions on structures exposed to fire

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- **Forward**
- **Section 1** – General
- **Section 2** – Structural Fire design procedure
- **Section 3** – Thermal actions for temperature analysis
- **Section 4** – Mechanical actions for temperature analysis
- **Annex A (informative)** – Parametric temperature-time curves
- **Annex B (informative)** – Thermal actions for external members – Simplified calculation method
- **Annex C (informative)** – Localised fires
- **Annex D (informative)** – Advanced fire models
- **Annex E (informative)** – Fire load densities
- **Annex F (informative)** – Equivalent time of fire exposure
- **Annex G (informative)** – Configuration factor

# EN 1991-1-2: Actions on structures exposed to fire ( cont.)

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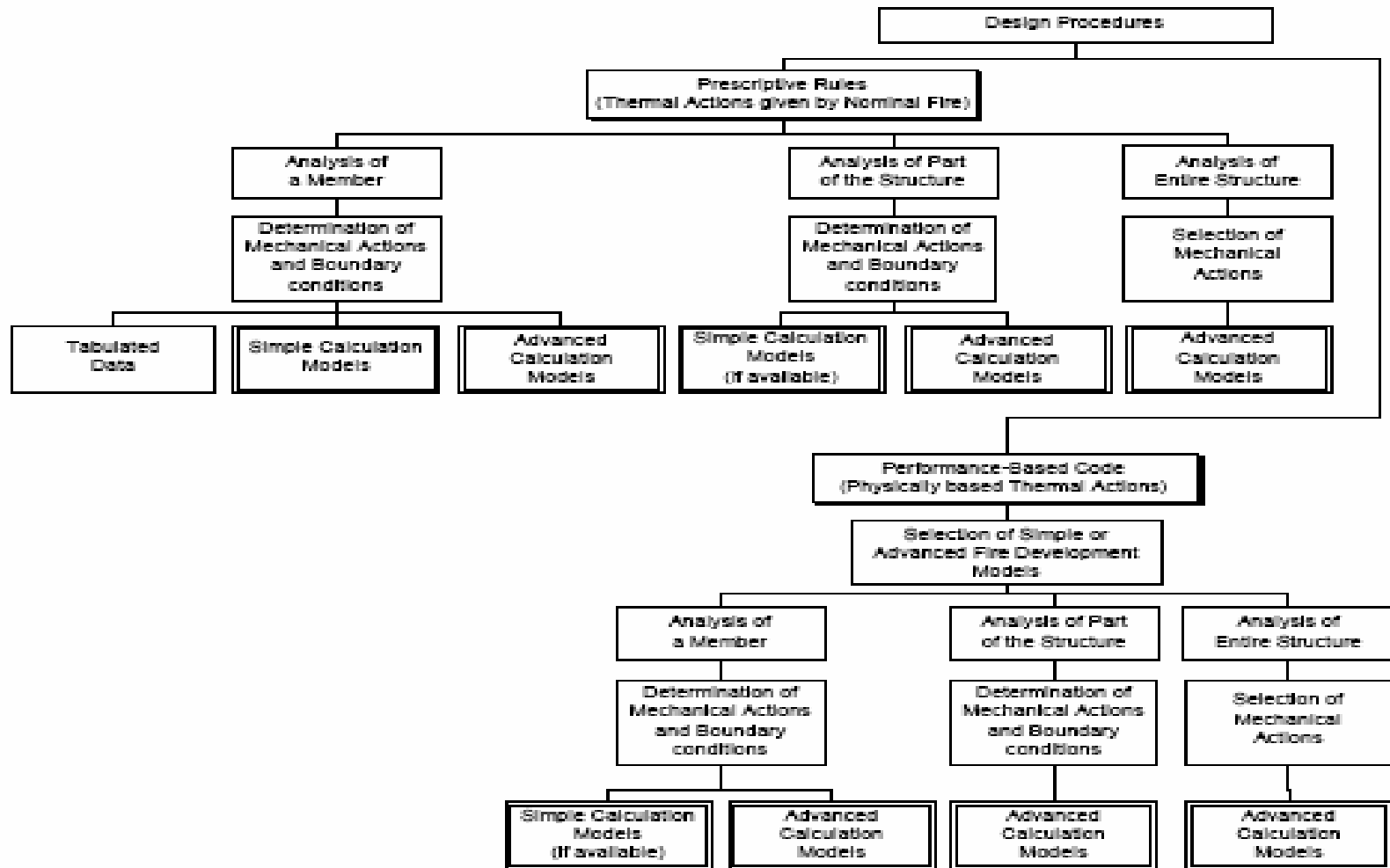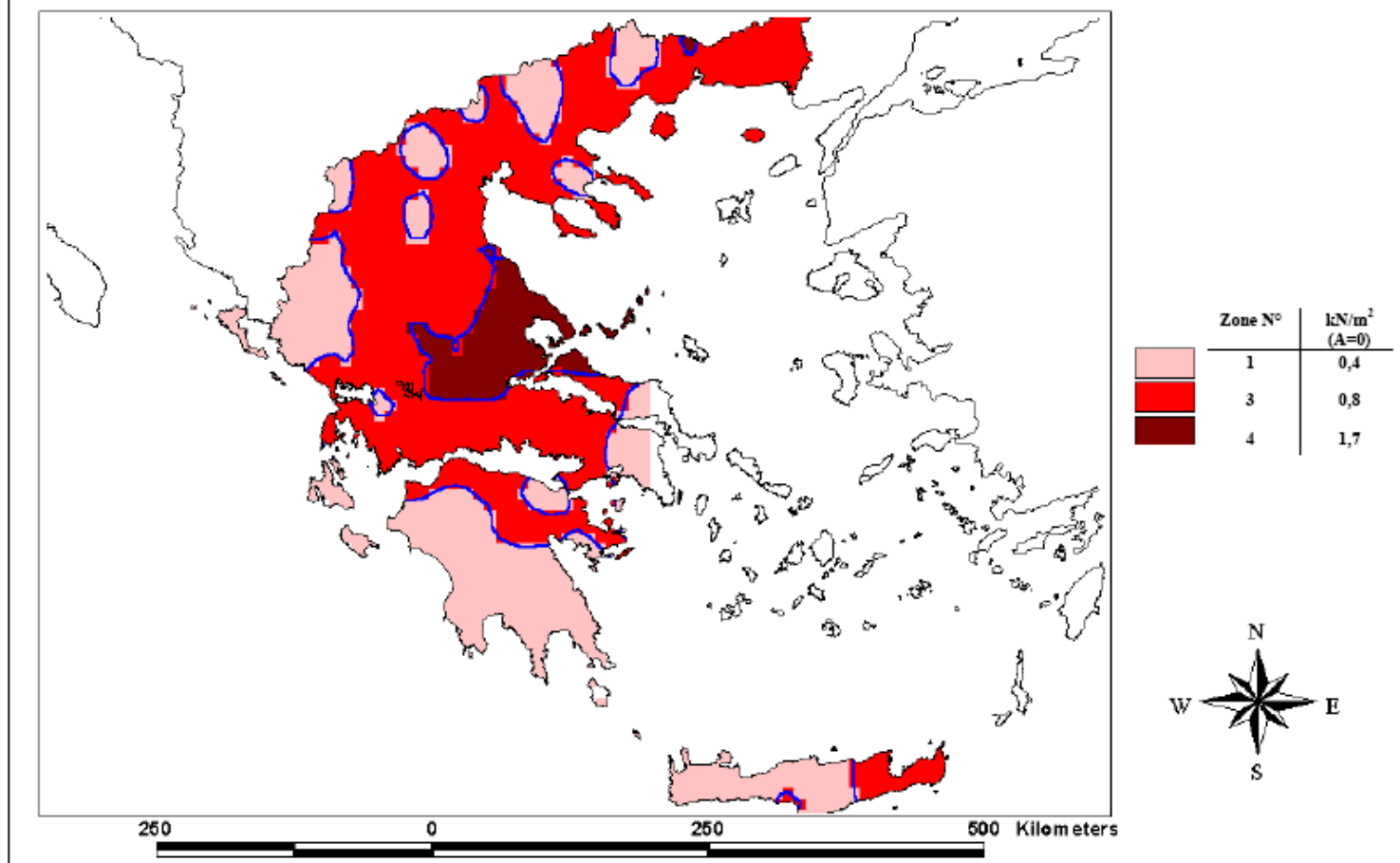Brussels, 18-20 February 2008 – Dissemination of information workshop

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Figure 1 — Alternative design procedures

- **Forward**
- **Section 1** – General
- **Section 2** – Classification of actions
- **Section 3** – Design situations
- **Section 4** – Snow load on the ground
- **Section 5** – Snow load on roofs
- **Section 6** – Local effects

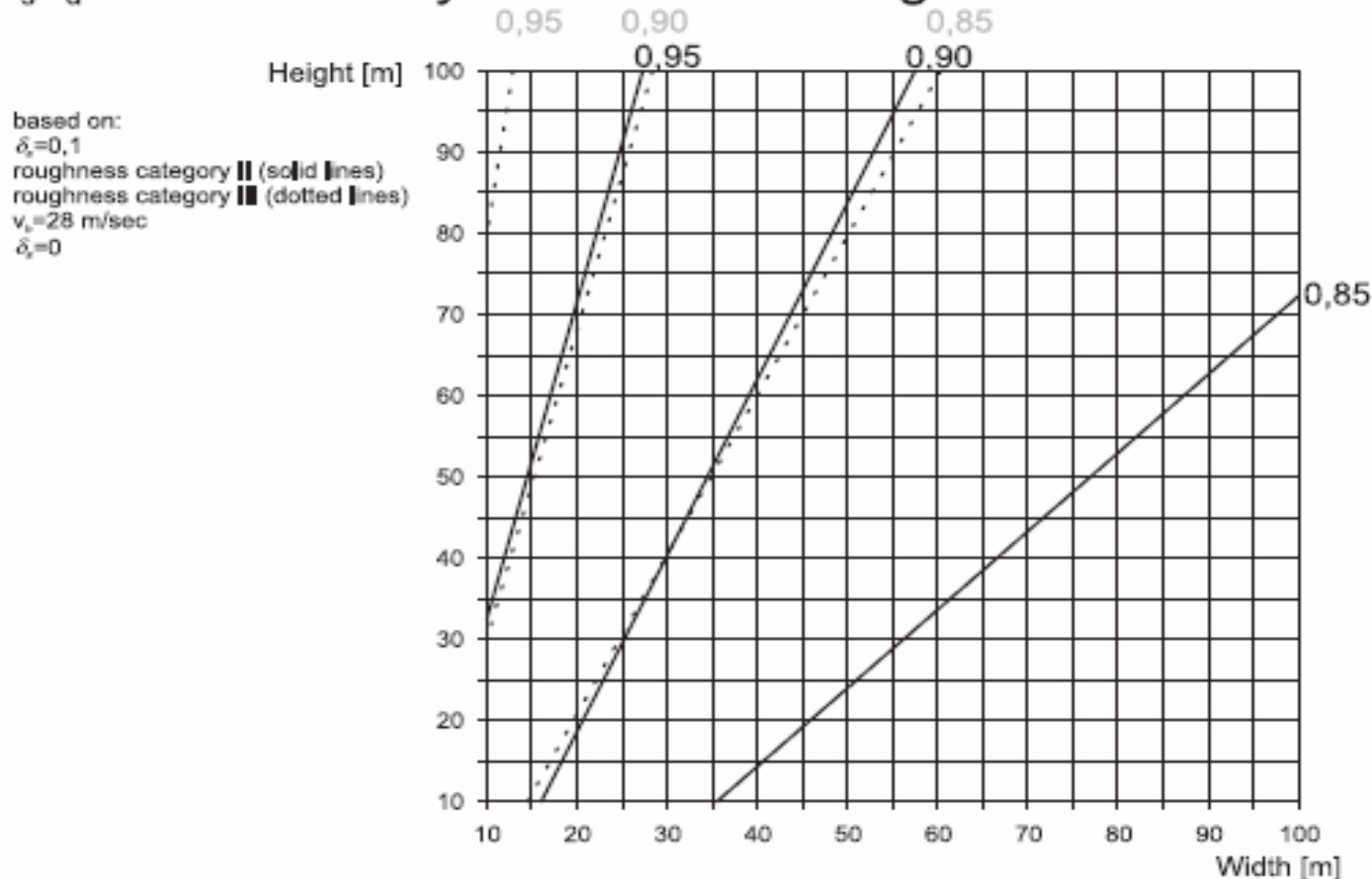- **Annex A** (normative) – Design situations and load arrangements to be used for different locations

- **Annex B** (normative) – Snow load shape coefficients for exceptional snow drifts

- **Annex C (informative)** – European Ground Snow Load Maps

- **Annex D (informative)** – Adjustment of the ground snow load according to the return period

- **Annex E (informative)** – Bulk weight density of snow

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EN 1991-1-3: Snow loads (cont.)

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Greece: Snow Load at Sea Level

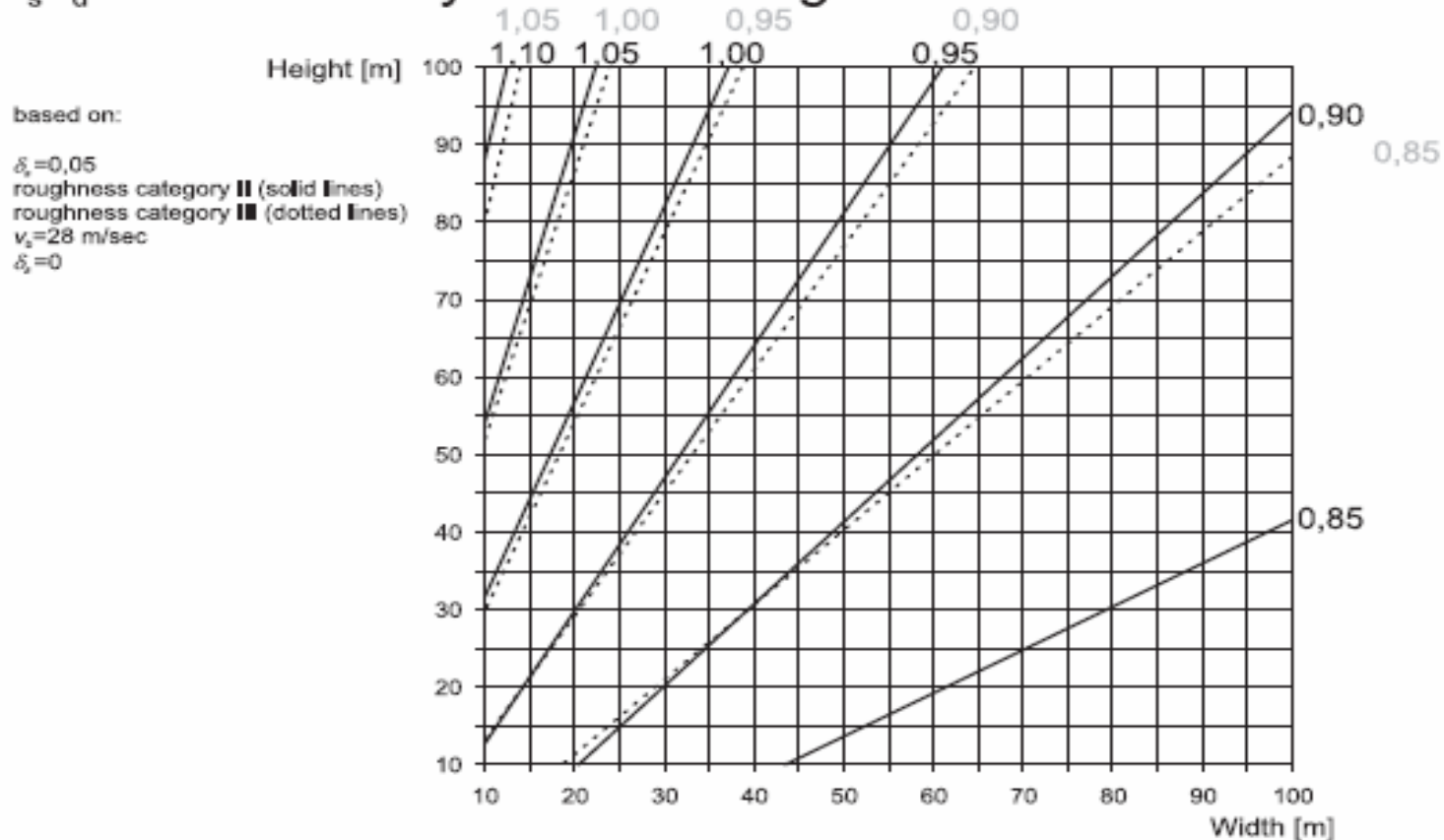| Zone N° | kN/m$^2$ (A=0) |
|---|---|
| 1 | 0,4 |
| 3 | 0,8 |
| 4 | 1,7 |

- **Forward**
- **Section 1** – General
- **Section 2** – Design situations
- **Section 3** – Modelling of wind actions
- **Section 4** – Wind velocity and velocity pressure
- **Section 5** – Wind actions
- **Section 6** – Structural factor $c_s\,c_d$
- **Section 7** – Pressure and force coefficients
- **Section 8** – Wind actions on bridges

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# EN 1991-1-4: Wind actions (cont.)

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## $c_s c_d$ for multistorey concrete buildings

based on:
$\delta_s = 0,1$
roughness category II (solid lines)
roughness category III (dotted lines)
$v_b = 28$ m/sec
$\delta_s = 0$



NOTE    For values exceeding 1,1 the detailed procedure given in 6.3 may be applied (approved minimum value of $c_s c_d = 0,85$)

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# EN 1991-1-4: Wind actions (cont.)

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# $c_s c_d$ for multistorey steel buildings



based on:

$\delta_s = 0,05$
roughness category II (solid lines)
roughness category III (dotted lines)
$v_b = 28$ m/sec
$\delta_s = 0$

NOTE    For values exceeding 1,1 the detailed procedure given in 6.3 may be applied (approved minimum value of $c_s c_d = 0,85$)

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EN 1991-1-4: Wind actions (cont.)

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- **Annex A (informative)** – Terrain effects
- **Annex B (informative)** – Procedure 1 for determining the structural factor $c_s\,c_d$
- **Annex C (informative**