

Example 6 Building Valuation and Redesign Study 3rd revision EIA 2022





EXAMPLE 6: "STUDY FOR THE VALUATION AND REDESIGN OF A BUILDING ACCORDING TO THE CANC.

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FOREWORD

The analysis methodologies used to evaluate or redesign existing reinforced concrete structures for seismic loads are elastic analyses, static or dynamic, and inelastic analyses (i.e. non-linear due to material), also static or dynamic. The elastic methods adopt the classical linear stress-strain relationship for the structural elements of the structure, where in approximate ways (e.g. using global or local indices of behaviour or ductility) they indirectly take into account the inelastic behaviour of the structure. These methodologies are simpler to apply, but may lead to less accurate results than their inelastic counterparts.

On the contrary, inelastic analysis methodologies help to better monitor and understand the actual response of the structures, demonstrating both the failure mechanisms and the potential for progressive collapse (it is therefore possible to control the deformations of the ends of the members, the overstrength reserves, as well as the way in which the plastic behaviour of the structure is triggered. In this way, inelastic analyses lead to a more rational and safer design. Inelastic dynamic analysis (i.e., time history analysis with direct numerical integration of nonlinear differential equations of motion) is the most complete and realistic methodology for the analysis of structures.

In the inelastic dynamic analysis the seismic action is introduced in the form of a history of base accelerations, either from actual recordings or from synthetic accelerograms. However, this analysis encounters problems in simulating the meteoric recurrent behaviour of the members of the structure, which is currently under scientific investigation and experimental verification. In addition, there is also the issue of appropriate selection of seismic accelerations, where the above analysis method is particularly sensitive.

Therefore, the design engineer conducting the assessment or redesign study of an existing structure using inelastic dynamic analysis should have considerable critical ability and experience. Thus, combined with its increased computational complexity, and the fact that the required analysis time even with modern computers is particularly high, especially in spatial analyses of high-rise buildings (note that because the analysis is non-linear, the principle of superposition does not apply), inelastic dynamic analysis is not considered practical for general use.

In contrast, the **static inelastic analysis** gives results that lie between the elastic methods and the inelastic dynamic method. It should be noted that, in the case where the externally applied load is horizontal seismic loads, the inelastic static analysis is also known as pushover analysis. Thus, although Pushover analysis does not have the accuracy of inelastic dynamics, since the seismic loads (which are dynamic) are taken into account approximately as static, it nevertheless leads to a significantly more accurate estimation of the response of the structure than elastic methods, and its application is much simpler than the corresponding inelastic dynamics.

It should be noted that inelastic static analysis is not a new methodology. However, in recent decades, extensive research has led to the development of simulations that allow the behaviour of reinforced concrete structural members after their theoretical failure to be estimated with reasonable accuracy, with the aid of appropriate

relationships (analytical or empirical) or tables. This is the reason why in recent years inelastic static analysis has been widely applied in the evaluation or redesign of existing buildings.

BASIC PRINCIPLES OF VALUATION AND REDESIGN IN ACCORDANCE WITH

EIA (3^h revision of the EIA 2022)

The Interventions Regulation KAN.EPE) aims to establish criteria for the assessment of the load-bearing capacity of existing structures and application rules for their seismic redesign, as well as for possible interventions, repairs or reinforcements.

Structures are mainly buildings with a load-bearing structure made of reinforced concrete (with or without damage).

It contains provisions of mandatory application, which specify:

 $\boldsymbol{\alpha}.$ The criteria for assessing the load-bearing capacity of an existing structure.

- β. The minimum mandatory load-bearing capacity requirements for redesigned structures or their members.
- c. Determining the ways in which intervention can be carried out.

 δ . The correlation of this Regulation with other Regulations (materials, loadings, etc.).

VALUATION OF EXISTING STRUCTURES (§2.1 OF THE CODE OF PRACTICE)

The term 'assessment' of an existing structure means the assessment of its available load-bearing capacity and the verification of compliance with the minimum mandatory requirements imposed by the regulations.

The assessment process leads to a decision on whether or not to intervene, and involves the following three stages:

- Data collection (research of the history of the structure)
- Analysis (of the structure as it is)
- Limit state control.

The valuation process varies depending on the existence or not of damage to the building to be valued.

REDESIGN (§2.4 OF THE ANNUITY SCHEME)

If a decision to intervene is taken, the "**redesign**" phase follows, consisting of the formulation and testing of one or more alternative intervention schemes that restore or enhance the load-bearing capacity of the structure.

As in valuation, there are three stages in the redesign process:

- Conception and preliminary design of the intervention scheme
- Analysis of the structure as it is intended to be developed
- Limit state control.

VALUATION AND REDESIGN OBJECTIVES (§2.2 OF THE REGULATION)

The whole philosophy of assessment and redesign is based on the so-called Performance Based Design, which is composed of a set of rules and criteria aimed at designing structures with predefined behaviour for a given level of seismic excitation.

By combining a Performance Level on the one hand and a Seismic Excitation Level on the other hand, a Design Objective (Assessment or Redesign) is obtained.

Performance levels §2.2.1

In order to serve wider socio-economic needs, various levels of performance (i.e. targeted behaviours) are established in the KANEPE, which relate exclusively to the supporting structure of the structure under consideration. In particular, the following three performance levels are defined according to the degree of damage:

 α . "Limited damage" (A) : The building structure is only slightly damaged, with the structural elements not having suffered significant leakage and retaining their strength and stiffness. The permanent relative floor movements are negligible.

 β . 'Significant damage' (B): the building structure has suffered significant and extensive but repairable damage, while the structural elements have residual strength and stiffness and are capable of supporting the intended vertical loads. Permanent relative floor displacements are moderate. The load-bearing structure can withstand moderate aftershocks.

c. 'Quasi-collapse' (C): the building's load-bearing structure has suffered extensive and serious or severe (mostly irreparable) damage. The permanent relative floor displacements are large. The load-bearing structure is still capable of supporting the intended vertical loads (during and for a period after the earthquake), but without any other substantial safety margin against total or partial collapse, even for moderate aftershocks.

<u>Correlation between return period and probability of exceeding the seismic action §2.2.1 (3^h revision of the 2022 EIS)</u>

The seismic excitation levels (i.e. the severity of the design earthquake) are defined based on the probability of exceeding a certain value of ground acceleration (depending on the seismic hazard of the area) in a certain period of time corresponding to the lifetime of the structure.

A nominal technical lifetime equal to the conventional lifetime of 50 years is generally accepted, irrespective of the presumed 'actual' remaining lifetime of the building.

In Table S 2.1, an indicative correlation of the return period and the corresponding probability of exceeding within the conventional 50-year lifetime of the seismic action with the corresponding reduced horizontal ground acceleration is presented.

Πίνακας Σ 2.1	Evô	εικτική συσ	χέτιση περιο	όδου επαναφ	ροράς και
	πιθα	νότητας υπέρ	οβασης της	σεισμικής ο	ρασης με
	την	αντίστοιχη	ανηγμένη	οριζόντια	εδαφική
	ERIT	άγυνση.			

Περίοδος Επαναφοράς (έτη)	Πιθανότητα υπέρβασης σεισμικής δράσης εντός του συμβατικού χρόνου ζωής των 50 ετών	$\alpha_g / \alpha_{g,ref}$
2475	2%	1.80
975	5%	1.30
475	10%	1.00
225	20%	0.75
135	30%	0.60
70	50%	0.45
40	70%	0.35
20	90%	0.25
<20	>90%	<0.25

Assessment and redesign objectives §2.2

The assessment or redesign objectives (Fig. 2.1) are combinations of a Performance Level on the one hand and a Seismic Action on the other hand, given a "tolerable probability of exceedance during the technical lifetime of the building" (design earthquake).

In the EIA CIP, reinspection targets are provided for, referring only to the load-bearing structure and wall fillings.

The choice of a specific valuation or redesign target implies the use of appropriately modified q or m indices, or tolerable deformations δd , the values of which are specified in Chap. 4 and 9.

It should be noted that the objectives of evaluation and redesign are not necessarily the same. Redesign targets may be higher than valuation targets.

Table 2.1 shows the correlation between the performance level of the load-bearing structure and the corresponding reduced horizontal ground acceleration.

	Στάθμη Επιτελε	εστικότητας Φέροντα	ος Οργανισμού
$\alpha_g / \alpha_{g,ref}$	Α «Περιορισμένες Βλάβες»	Β «Σημαντικές Βλάβες»	Γ «Οιονεί Κατάρρευση»
1.80	A0	B 0	Г0
1.30	A1 ⁺	B1 ⁺	Γ1+
1.00	A1	B1	Γ1
0.75	A2 ⁺	B2+	Γ2+
0.60	A2	B2	Г2
0.45	A3+	B3+	Γ3+
0.35	A3	B3	Г3
0.25	$A4^+$	B4 ⁺	$\Gamma 4^+$
< 0.25	A4	B4	Γ4

Πίνακας 2.1. Στόχοι αποτίμησης ή ανασχεδιασμού Φέροντος Οργανισμού.

• αg , ref is the horizontal ground acceleration reference, defined with a 10% probability of exceeding the seismic action in the 50 years of the conventional life of the project.

• αg is the horizontal ground acceleration.

Indicatively, for new structures, a design objective B1 is provided according to Pin. 2.1.

Adopting a valuation or redesign target with a probability of exceeding the seismic action greater than 10% generally results in more frequent, more extensive and more severe damage compared to a corresponding target with a probability of exceeding the seismic action of 10%, while when the probability of exceeding the seismic action is less than 10%, generally less frequent and less damage is expected.

The probability of overrun:

- 30% in 50 years corresponds to an average recovery period of about 135 years,
- 10% in 50 years corresponds to an average recovery period of about 475 years.

The choice of a specific valuation or redesign target implies the use of appropriately modified q or m indices, or tolerable deformations δd , the values of which are specified in Chap. 4 and 9.

In the previous revision of the Regulations, Appendix 2.1 was added, which includes the minimum acceptable targets for the assessment or redesign of an existing building.

The Minimum Wind Assessment Targets provided in §2.2 in relation to the Performance Level of the load-bearing structure and the probability of exceeding the Seismic Action within the contractual life of 50 years, are defined according to the importance category of the building as follows:

Κατηγορία Σπουδαιότητας	Ελάχιστοι Ανεκτοί Στόχοι
I	Г2
II.	Г1
JII	B1
IV	B1 και A2 (Ικανοποίηση και των δύο στόχων)

Πίνακας ΠΑ.2.1. Ελάχιστοι ανεκτοί στόχοι αποτίμησης ή ανασχεδιασμού υφισταμένων κτιρίων.

Σε κάθε περίπτωση να θεωρηθεί ότι ισχύει A1>A2, B1>B2, Γ1>Γ2, A1>B1>Γ1 και A2>B2>Γ2

The four categories of importance are defined according to Annex 2.1 of the EIA and buildings are distinguished into (I) buildings of minor importance in terms of public safety, (II) in ordinary buildings,

(III) buildings housing establishments of very high economic importance and public assembly buildings; and (IV) in buildings whose function is vital during and after the earthquake.

Investigation, documentation of the load-bearing structure of an existing structure §3

Prior to the preparation of any valuation or redesign study, it is necessary to investigate and document the existing structure to a sufficient extent and depth in order to make the data on which the valuation or redesign study will be based as reliable as possible.

This requires

- the recording of the structure and its condition,
- the compilation of the history of the construction and its maintenance,
- the recording of any damage or deterioration, and
- the performance of on-site exploratory work and measurements.

\$3.1 Damage and deterioration are recorded regardless of whether they are caused by earthquake or other actions (fire, environmental actions, etc.).

Depending on the intensity and extent of the damage or deterioration, and as far as the usability of the building is concerned, the following cases are mentioned:

i. <u>No or minor damage</u>: The building can be used without restrictions.

ii. <u>Severe damage</u>: The ability to use the building should be severely restricted until a more accurate and final assessment of the situation is made. The possibility of safety measures and shoring or bracing should also be considered.

iii. <u>Severe damage, with or without collapse</u>: Access to the building and access to the surrounding area should be prohibited. Parts likely to collapse suddenly should be demolished immediately and immediate intervention measures should be considered (see § 3.4.e).

Inspection procedures, checklists and other data collection procedures will follow professional or public agency specifications and should be compatible with the means available for inspection, investigation and repair/reinforcement measures.

However, it may be difficult to always collect such detailed information. In such cases, uncertainties can be addressed by introducing the concept of

"data reliability level" (see § 3.7).

There are three Categories of Data Reliability Level S.A.D. §3.6.2:

- "High."
- "Satisfactory"
- "Windy"

The 3th revision of the EIA brings changes that also have to do with the Data Reliability Levels. To be more precise, and until now there were individual SDSs. More specifically there was:

- Material SDS that affected the Resistances (Strengths). It is distinguished into SADIS (Concrete) and SADYX (Steel). In the program there was in the definition of material strength in the dimensioning.
- Geometric data of the structure based on the following table. The table that existed until now and is related to geometry and reinforcements. The geometric data

affect the actions. In the program, it is the option in the analysis scenario and affects the coefficient of permanent loads yg.

		-			AEAOMENA								
ΣΧΕΔΙΑ ΑΡΧΙΚΗΣ ΜΕΛΕΤΗΣ			ΠΡΟΕΛΕΥΣΗ ΔΕΔΟΜΕΝΟΥ	DAPA TH PROLED	TEΩ! ΘE	ΕΙΔΟΣ Κ ΜΕΤΡΙΑ ΜΕΔΙΩΣ ΔΝΩΔΟΜ	ΑΙ ΦΟΡΕΑ ΗΣ Ή ΙΗΣ	TOIX EII EIIEN	H, BAPI OIIAHPI ITTPOTI NAYTEO	Η κ.λ.π. ΣΣΕΩΝ, ΞΩΝ, Ν κ.λ.π.	AL/ AEL	ATAEH I ITOMEP OILAIEH	CAI EIEΣ Σ
VILAPNOVN	NADVALIN				Avactif	humanut	Yunki	Averti	formation	liyluk A	Austri	homentrui	Think?
\checkmark	9	1	Δεδομένα που προέρχεται από σχέδιο της αγχικής μελέτης η οποία έχαι αποδεδειγμένα εφαρμοστα, χαράς τροποτοιήσεις	(1)			\checkmark			J			\checkmark
\checkmark	(2	Διδομίνο και προτρχεται από σχώο της αρχηκής μελέτης η οποία έχει πραρμοστεί με λίγες τροποποιμούς	(2)			\checkmark			\checkmark		1	
1		3	Δεδομίνο που προέρχεται από αναφορά (κ.χ. υπάργημα αι αχόδια της αρχασίς μελέτης)	(3)	\checkmark			\checkmark			\checkmark		
	\checkmark	34	Δοδομένο που έχει διαπιστοιθεί ήγκαι μετρηθεί ψγκαι αποτυποιθεί αξιδαμιτα	(4)		\checkmark			4			1	
	\checkmark	5	Δεδομένο του έχει προσδιοριστεί με εμμεύον μέλα επεριούς αξιόπατον τρότο	(5)	\checkmark	\checkmark		\checkmark	\checkmark		\checkmark	\checkmark	
	\checkmark	6	Δεδομένο και έχει επόδησι; θεοορήθει κατά την κρίου Μηχανικού	(6)	\checkmark	\checkmark		\checkmark	\checkmark		\checkmark	\checkmark	

ΠΙΝΑΚΑΣ 3.2: ΣΤΑΘΜΗ ΑΞΙΟΠΙΣΤΙΑΣ ΓΕΩΜΕΤΡΙΚΩΝ ΔΕΔΟΜΕΝΩΝ

With the 3^h revision of the EIA CIP

The corresponding table in Revision 3^a concerning the geometry and layout and armament details

			3	Πίναιο	a; 3.2 El	LIVOLI	EAAr KA	I SAAA						
					0			and a second	AEAOMEN	IA.	22	A20040		
ΣXE	AIA				(m)	η δυσμεν	ς έστερη με	ΣΑΔr ταξύ των 3	2 \$ cAAn	A.Ar2)		ΣΑΔΑ		
APXI MEAI	CIKHY METHY TIPOEAEYYH AEAOMENOY		THPHEER	ELΔΟΣ ΦΟΡΕΛ ΑΝΩ	KALTES ØEME/ MMHE	δΜΕΤΡΙΑ ΜΩΣΗΣ ή ΣΑΔΓι)	ILA TOE EIIENA	ΧΗ. ΒΑΡΗ ΧΟΙΊΑΗΡΩΣ ΠΙΣΤΡΩΣΕΩ ΓΣΕΩΝ κ.λα	κ.λπ. ΞΕΩΝ. 2Ν. (ΣΑΔη2)	AE	IATAEH H IITOMEP OIIAISH	CAL EIEX E		
VILAPSOVY	ARM ARMANN				UAPA	Aventi	harmonical	(LANA),	Averti	[convocution]	Verila	(LENONY)	processing	hidad.
1		1	Δεδομένο που προέρχεται από σχόδιο της αρχικής μελέτης η οποία έχει μποδεδάτεμένα εφορικοττά, χορές τροτοποσήστες	(1)			\checkmark			\checkmark			\checkmark	
\checkmark		2	Δαδομίνο που προξοχετοι από σχέδιο της αρχικής μαλάτης η οτοίο έχοι εφορμοστοί μα λίχες τροποποιήσεις	(2)			\checkmark			\leq		1	\checkmark	
\checkmark		3	Δεδομένα που προέρχεται από αναφορά (π.χ. υπόμνημα πε αχάδιο της αρχικής μελέτης)	(3)	\checkmark			\checkmark			\leq			
	\checkmark	4	Δεδομίνο που έχει διατιστοθεί ή/και μετρηθεί ή/και αποτοποθεί σξιάποτα	(4)		\checkmark	\checkmark		\checkmark	\checkmark		\checkmark	\checkmark	
	\checkmark	5	Δεδομένο που έχει προσδιοριστεί με δημετίον κλλά επόρκος σξιόποτον έρδεο	(5)	\checkmark	\checkmark		\checkmark	\checkmark		\checkmark	\checkmark		
	\checkmark	6	Δεδομένο που έχει ευλόγος θεορηθεί κατά την κρίση Μηχανικού	(6)	\checkmark	\checkmark		\checkmark	\checkmark		1	\checkmark		

- The SDS relating to geometry was named SDG with two subcategories SDG1 and SDG2 and the SDS relating to the • layout and reinforcement clamping details was named SDL.
- ٠ Until now, only the material's SWD was taken into account for the determination of strengths. In the new revision for the determination of the strength of steel in terms of forces very logically, the SADL is also taken into account.

Thus the coefficients affecting the strengths of the materials are as follows:

<u>ΠΙΝΑΚΑΣ ΙΙ 4.1</u> :	: ΤΙΜΕΣ ΙΔΙΟΤΗΤΩΝ ΤΩΝ ΥΛΙΚΩΝ (που διαμορφώνουν τις αντιστάσεις) ΚΑΙ ΑΝΤΙΣΤΟΙΧΟΙ ΕΠΙΜΕΡΟΥΣ ΣΥΝΤΕΛΕΣΤΕΣ ΑΣΦΑΛΕΙΑΣ γ΄π							
	ΣΕ ΟΡΟΥΣ ΔΥΝ	AMEQN ²	ΣΕ ΟΡΟΥ:	E IIAPAMOP4				
	VARY TAMENA VARYAR	TIBOVTIOTMENA	VAINTANE	IIDOXTI				

	ΣΕ ΟΡΟΥΣ ΔΥΝ	AMEΩN ¹	ΣΕ ΟΡΟΥΣ ΠΑΡΑΜΟΡΦΩΣΕΩΝ ³			
	ΥΦΙΣΤΑΜΕΝΑ ΥΛΙΚΑ ⁶	ΠΡΟΣΤΙΘΕ	MENA	ΥΦΙΣΤΑΜΕ	ΠΡΟΣΤΙΘ	EMENA
	one construction and the construction of the	KANONE	IOM	NA YAIKA	KANON	IEMOI
		Nat	Oga	ŝ.	Nat	Op
Αντιτροσιοπιστικές πρές ⁵	— X - s	Xa	Xa	x	x	x
$ \begin{array}{c} {\rm Extrachords} \\ {\rm southersets} \\ {\rm s$	Για το σκυρόδεμα: Αναλόγας ΣΑΔ _Υ Υ ε = 1,30±0,15 Για τον χάλοβο οπλισμού: Για ΣΑΔ _Α «Υψηλή» και αναλόγος	Αναλόγιας διατομής ή / και προσπελασιμότητας		Αναλόγος ΣΑΔγ	Αναλόγως διατομής ή / κοι προσπελασιμότητας	
	$102A\Delta_0 \approx 1$ ψημομικώς σύσλογμης $\Sigma A\Delta_0 \gamma \gamma_s = 1.040.05$ Για ΣΑΔ ₀ «διανούσιητική» και αναλόγος ΣΑΔηγγ ₁ = 1.1540.05 Για ΣΑΔ ₀ «Ανακτήν και αναλόγος ΣΑΔηγγ ₁ = 1.2040.05	-γm•(1.05 ή 1.20)	Αυξημένοι	γ' _{in} =1,10±0,10	γ'a≃1,15 ἡ 1.25	γ'a=1,15 ή 1,25

•

• Uristiqueses toccaling/dises: γ_0 =1.5 ± 0.2. • Prostidiaeses toccaling/dises: γ_0 =1.70 + 3.00, b). EK 6.

For your convenience they are detailed below:

ώνε Υψηλή	Ικανοποιητική	Ανεκτή
γ _m =1.15	γ _m =1.30	γ _m =1.45
(ίσχυε	: και στη 2ª αναθεώρ	ηση)
Για Χάλυβα	(ΣΑΔ _{ΥΧ}) - (Υλικό & /	Λεπτομέρε
άνκε Υψηλή	Ικανοποιητική	Ανεκτή
2	ΕΑΔ _Λ : «Υψηλή»	
γ _m =1.05	γ _m =1.10	Y _m =1.15
ΣΑΔ,	ς: «Ικανοποιητική»	
y=1.10	Vm=1.15	γ _m =1.20
2	ΑΔ _Λ : «Ανεκτή»	
ym=1.15	γ _m =1.20	y _m ≠1.25
(3'	αναθεώρηση)	
D (r)	·	

(ίσχυε και στη 2" αναθεώρηση)

It is recalled that for the elastic analyses (checks in terms of forces - intensities) the representative (characteristic) strength value of the materials is the mean value minus one standard deviation, while for the inelastic analyses (checks in terms of deformations) and for the m method the representative (characteristic) strength value of the materials is the mean value. Method m is considered to belong, as far as the determination of strength is concerned, to the inelastic methods.

The EIS provides criteria for determining the S.A.D. §3.6.4 and Minimum investigation requirements for material characteristics, evaluation of results and definition of S.A.D. §3.7

In addition, in cases where it is objectively impossible to carry out the inspection and investigation programme (§§ 3.5 and 3.6) for the characteristics of the materials, and if no problems of defects, wear and tear, damage, etc. are found, reliable results of previous quality inspections may be used to document the strength of the materials.

Although these are not available, it is possible, exceptionally, to use 'in absentia' representative material strength values in accordance with Annex 3.1. In this case the Data Reliability Level (DRL) is considered 'tolerable' for concrete and masonry infills and 'satisfactory' for reinforcing steel.

ANNEX 3.1

"EREMIN" REPRESENTATIVE PRICES OF MATERIAL RESISTANCE

α) Για το σκυρόδεμα

Πίνα κας 1. «Ερήμην» Αντιπροσωπευτικές Τιμές Θλιπτικής Αντοχής Σκυροδέματος.

Εφαρμοσθέντες Κανονισμοί Μελέτης και Κατασκευής	«Ονομαστική» Μέση τιμή $f_{cm}(M\!Pa)$	«Χαρακτηριστική» Μέση τιμή μείον μία τυπική απόκλιση $f_{ck} \left(M\!Pa ight)$
<1985	13	9
198 5 <u>≤</u>	17	13

β) Για το χάλυβα οπλισμού

Πίνα κας 2. «Ερήμην» Αντιπροσωπευτικές Τιμές Διαρροής Χάλυβα Οπλισμού.

Κατηγορία Χάλυβα Οπλισμού	«Ονομαστική» Μέση τιμή $f_{_{\mathcal{Y}^{\mathrm{m}}}}(M\!P\!a)$	«Χαρακτηριστική» Μέση τιμή μείον μία τυπική απόκλιση $f_{_{yk}} \left(M\!Pa ight)$
S220 & Stahl I	280	240
S400 & Stahl III	450	410
S500 & Stahl IV	520	500

Security check

The safety check, carried out on an appropriate member or part or the whole structure, shall demonstrate that the imposed critical magnitude (stress and/or strain) is reliably less than the corresponding available capacity. The safety factor applied in the assessment and redesign of existing structures is in the same general form as provided for in the Eurocodes:

```
Sd< Rd, with
Sd= γSd· S (Sk· γf) and
Rd= (1/γRd)· R (Rk/γm),
```

where:

• Sd: The design (and recheck) values of the stress or strain magnitudes caused by the actions.

• Rd: The design (and retest) values of the available corresponding resistances (transient or deformation magnitudes).

• Sk: The representative values of the baseline and random actions for which there is a certain probability of exceedance in 50 years.

• **Rk:** The representative values of the properties of the materials forming the resistances and having a certain probability of undercutting.

• **vf**, **ym**: the individual safety factors for the actions and properties of the materials, which take into account possible adverse deviations of the respective variables from the representative values.

• **ySd**, **yRd**: The individual safety factors that take into account the increased (compared to the design of new buildings) uncertainties of the simulations, through which the effects of the actions and the resistances of all kinds are estimated, respectively (see also Chapter 2, paragraphs 2.4.3 and 2.4.4.)

Finally, the safety inequality is checked by what is mentioned in more detail in Chap. 9, depending on the level of performance (see Chapter 2 of the CEFR).

Individual safety factors §4.5

Depending on the reliability of the data:

i. Appropriate safety factors γf are selected for certain actions with uncertain values, in combination with appropriate γSd (see § 4.4 and 4.5).

ii. Appropriate safety factors γm are selected for the existing material data, in combination with appropriate γRd (see § 4.4 and 4.5).

For the Simulators § 4.5.1

For the analysis simulations and for all tests, appropriate values of the individual safety factors γ Sd and γ Rd are used in order to take into account the increased uncertainties that accompany them.

The coefficients yRd are obtained in accordance with the provisions of Chapters 6 to 9 of the EIA.

The csd coefficients are obtained according to the severity and extent of the damage and deterioration suffered by the structure under study and are presented in Table C4.2 of CEE:

Πίνακας	Z 4.2:	Ture:	too govt	ελεστή γεα

Έντονες και εκτεταμένες βλάβες ή / και επεμβάσεις	Ελαφρές και τοπικές βλάβες ή / και επεμβάσεις	Χωρίς βλάβες και χωρίς επεμβάσεις
γ _{8d} =1,20	γ _{Sd} =1,10	γ _{sd} =1,00

Βλ. και Παράρτημα 7Δ και Παράρτημα ΣΤ περί βλαβών και φθορών.

Also, according to Chap. 5, and as far as elastic analysis, static or dynamic, is concerned, its application is permitted, for valuation purposes only, irrespective of the validity of the application conditions (see §§ 5.5.2.b and 5.6.1.b), if the γ Sd factors in this § 4.5.1 are increased by 0.15 (i.e. γ Sd,el. = γ Sd + 0.15).

<u>Analysis</u>

The determination of the building's stresses and strains requires the analysis of the building for the combinations of actions defined in § 4.4.2. Based on the stresses and strains resulting from the analysis by one of the recommended methods (§ 5.1.1), the corresponding checks for the satisfaction of the performance criteria, as described in §§5.1.3 and 5.1.4, as well as in Chap. 9.

The methods that can be used for the analysis are:

- Elastic (equivalent) static analysis (see §5.5), with global behaviour index (q) or local index (m)
- Elastic dynamic analysis (see §5.6) with global behaviour index (q) or local index (m)
- Elastic static analysis (see §5.7)
- Inelastic dynamic analysis (time history analysis) (see §5.8).

The selection of appropriate method is based on the importance and any damage or deterioration of the structure, as well as the available data on the cross-sections and strengths of the structural elements. In addition, the choice is also influenced by certain conditions that must be met for each method. These conditions are mainly related to the S.A.D. and the normality or otherwise of the structure under consideration.

Allows the distinction of elements into primary and secondary* (except for S.E. "A").

*Secondary elements will be those elements that contribute to vertical loads but do not contribute significantly to earthquake resistance, or their contribution is rather unreliable due to low stiffness or strength or ductility. This category includes wall-coupling beams and, in general, relatively short beams contributing to walls, beams with indirect supports on beams, planted columns, etc. The distinction between primary and secondary elements is at the discretion of the engineer.

4.6 SINGLE INTEREST INDICATOR q

The estimation of the available single index of behaviour of an existing structure depends on whether the building is damaged or not, as well as on the date of construction.

Depending on the performance level for the assessment or redesign of the building's load-bearing structure (see Chapter 2), the differentiated values of q^* given in the following Table are taken into account, with the reference value q' being the value applicable to

performance level B ("Significant damage"), which corresponds to the provisions and provisions of EC 8-1, as applicable to the design of new buildings.

Πίνακας 4.1 :	Τιμές του λόγ	ου q*/q΄	αναλόγως	του στόχου
	επανελέγχου (για τον φ	έροντα οργ	ανισμό)

Στάθμη επιτελεστικότητας					
«Περιορισμένες βλάβες» (A)	«Σημαντικές βλάβες» (B)	«Οιονεί κατάρρευση» (Γ)			
0,6 πάντως δε 1,0 <q*<1,5< td=""><td>1,0</td><td>1,4</td></q*<1,5<>	1,0	1,4			

According to Table S4.4 of CEE.EPE, the values of the behaviour index q are proposed for performance level B (significant damage), depending on the damage and the effect of the wall fillings on the whole structure:

Πίνα κας Σ 4.4: Τιμές του δείκτη συμπεριφοράς η' για την στάθμη επιτελεστικότητας Β («Σημαντικές βλάβες»)

Εφαρμοσθέντες Κανονισμοί μελέτης (και	Ευμενής παρο απουσία τοιχοπληρώσε	υσία ή ι :av (1)	Δυσμενής (παρου τοιχοπληρά	γεντκώς) σία σεων (1)
κατασκευής)	Ουσιώδεις βλά πρωτεύοντα σ	άβες σε τοιχεία	Ουσιώδεις βλάβες σε πρωτεύοντα στοιχεία	
	Όχι Ναι		ŊΩ	Na
<u>1995≤</u>	3,0	2,3	2,3	1,7
1985 <u><</u> <1995(2)	2,3 1,7		1,7	1,3
<1985	1,7	1,3	1,3	1,1

4.7 LOCAL INDICATORS m

The local indices m express the available local plasticity in the control areas of the linear elements. The local index m is defined as the ratio of the design value of the limiting strain depending on the level of performance to the corresponding value of the yielding strain of the linear member (CEE § 4.7) : //==

The deformation magnitude taken into account in the calculation of the m indices is

- the chord angles of twist $\boldsymbol{\theta},$ for reinforced concrete members, and
- the angular deformations c, for wall fillings.
- At performance level A, the load-bearing structure (and the wall fillings) is expected to behave quasi-elastic, i.e. without the development of meteorological deformations. It is valid that θd≤ θy (i.e. m≈ 1.0), or respectively using the single behaviour index 1.0 ≤ α ≤ 1.5.
- At performance level B, the load-bearing structure develops significant post-tensioning deformations over a large area, but has sufficient and reliable margins against possible exhaustion of available failure strains. For the primary elements it holds that $\theta d \approx 0.5(\theta y + \theta u)/yRd$, while for the secondary elements $\theta d \approx \theta u/yRd$.
- At performance level C, the load-bearing structure develops large metamorphic deformations, over a large area, reaching even the exhaustion of the available failure deformations, but without risk of collapse under gravity loads. It holds for primary elements that $\theta d \approx \theta u / \gamma R d$, while for secondary elements $\theta d \approx \theta u$.

4.4.1.3 Response spectra

Generally, the response spectra in terms of acceleration, according to EC 8-1, are used as a function of the building's eigenperiod T and the critical viscous damping rate ξ or the behaviour index q.

If linear analysis methods are applied, with a global behaviour index q, the "design spectra", Sd(T), are used.

In case of application of non-linear methods of analysis, as well as linear methods using a local index m, the "elastic spectra", Se(T), are used.

In very specific cases, and only for the valuation of an existing structure, other approximate or empirical methods may be used.

4.4.1.4 Stiffness

Where more precise data are not available, stiffness values according to the Table below may be used.

4.4.2 Combinations of actions

Πίνακας Σ 4.1: Τιμές δυσκαμψίας

A/A	Δομικό στοιχείο	Δυσκαμψία
1.1	Υποστύλωμα εσωτερικό	0,8*(EcIg)
1.2	Υποστύλωμα περιμετρικό	0,6*(EcIg)
2.1	Τοίχωμα, μή - ρηγματωμένο	0,7*(EcIg)
2.2	Τοίχωμα, ρηγματωμένο (1)	0,5*(EcIg)
3	Δοκός (2)	0,4*(EcIg)

EXAMPLE 6: "STUDY FOR THE VALUATION AND REDESIGN OF A BUILDING ACCORDING TO THE CANC.

The combinations of actions, both for the failure limit states (basic and accidental combinations) and for the operational limit states, are made in accordance with the current Regulations in force and with the corresponding combination coefficients of the variable actions ψ i.

4.4.3 Resistors

 α) For the resistances of each structural element, the safety check (see § 4.1) is carried out with material properties generally dependent on the nature of the critical quantity to be checked (forces or deformations):

If the safety check is carried out **in terms of intensive quantities ("forces")**, the properties of the existing materials of a particular (individual) structural element are generally represented by **their average values reduced by one standard deviation** (or simply their average values, see Chapter 9), and the properties of the added materials are represented by their characteristic values as provided for in the relevant Regulations.

In this case, the material safety factors shall be taken as in §§ 4.5.3.1 and 4.5.3.2. The calculation of the stiffnesses is done according to § 4.4.1.4.

If the safety check is carried out in **terms of deformation quantities (displacements, rotations, etc.)**, the properties of the materials are generally represented by their **average** values. *See also the following. See also § 4.1.4.*

In this case, the material safety factors are approximately equal to unity (§ 4.5.3.3).

The shape of the operation

When the assessment study of a structure concludes that intervention is required, the engineer, adopting one or more strategies, chooses the form of intervention based on general and technical criteria. Before any reference is made to the strategies, formulas and selection criteria, it is useful to clarify the terms

"intervention", "repair" and "reinforcement".

The term structural "intervention" means any work which results in the desired change in the existing mechanical characteristics of an element or structure and which has the effect of modifying its response. Any intervention is either repair or strengthening.

The term '**repair**' means the process of intervention on a structure damaged by any cause, which restores the predamage mechanical characteristics of the structural elements of the structure and returns it to its original load-bearing capacity.

The term '**strengthening**' means the process of intervention in a structure, with or without damage, which increases the load-bearing capacity or ductility of the element or structure to a level higher than that of the original design.

The choice of the intervention scheme is part of one or more strategies aimed at improving the seismic behaviour of the structure under consideration and consists of the modification or control of key parameters.

The SCADA Pro

SCADA Pro has now fully integrated the CIP. With predefined parameters and automatic way all the necessary analyses are performed, all the checks of the performance criteria provided by the CIP are performed and the results are presented in a direct and supervisory way.

Anelastic static analysis also provides information and complete overview of the order of occurrence of plastic joints in the limbs. The designer now has a complete picture of the gradual deformation of the member at each step and can easily and quickly identify the "weak" points of the structure.

This method is mainly used in the assessment and control of the load-bearing capacity of existing buildings in relation to a defined level of performance, i.e. the desired and targeted behaviour of the building, based on the new regulation on interventions (KAN.EPE). It can also be used in redesign as well as in new buildings in order to determine from the resistance curve of the structure the ratio au/ai required, according to EC8, for the calculation of the seismic behaviour factor q of the structure.

REQUIREMENTS

A prerequisite for the execution of an inelastic analysis scenario is the existence of reinforcement in the cross-sections, which results from dimensioning ONLY with Eurocode 2 scenario with adaptation of the strengths of the Steel and Concrete materials to the strengths of the existing structure. The materials to be used shall NOT be B and STI grade (old material grades) but the adjustments of strengths and individual safety factors shall be based on the new materials.

INTRODUCTION

This manual was created to guide the researcher in his first steps in the field of inelastic analysis.

As an example, a three-storey reinforced concrete structure, considered as existing, was used in order to evaluate and check its load-bearing capacity in relation to a defined level of performance and is a guide for the new user in his effort to familiarize himself with the program.

GENERAL DESCRIPTION

A. Geometry

The building under study consists of three floors in the superstructure, a foundation level and a roof slab. The foundation consists of footings and a footing under the elevator core.



B. Materials

For the construction of all members of the structure, concrete of C20/25 quality has been used, and for the reinforcement, steel of B500C quality.

In case that in the existing construction to be checked, quality B and STI materials (old material grades) were used, then they will NOT be imported as they are, but will be adapted to the strengths and individual safety factors of the new materials.

C. Regulations

Eurocode 8 for seismic loads. Eurocode 2 for dimensioning. Intervention Regulation (CEN.EPE).

D. Loading - analysis assumptions

- Dynamic Spectral Method with homonymous torsional pairs.

The loadings according to the above analysis method in SCADA Pro are as follows: (1) G (permanent)

(2) Q (mobile)

(3) EX (epicyclic loads forces of the earthquake at XI, from dynamic analysis).

(4) EZ (epicyclic loads forces of the earthquake at ZII, from dynamic analysis).

(5) Erx \pm (epicentric torsional moment loads resulting from the epicentric forces of the earthquake XI displaced by the random eccentricity $\pm 2e\tau zi$).

(6) Erz±(epicyclic torsional moment loads resulting from the epicyclic forces of the earthquake ZLI displaced by the random eccentricity ±2etxi.

(7) EY (vertical seismic component -earthquake by y- from dynamic analysis).

- **Pushover Analysis**. The simulation is subjected to horizontal loads distributed in a manner proportional to the inertial forces of the earthquake, which will increase monotonically, generally until a structural element is no longer able to carry its vertical loads.

1°STEP 1: PRELIMINARY PROCEDURE

The data input of a structure in order to evaluate or redesign it is done by following exactly the same procedure as described for the design of a new project.

The detailed description for the creation, solution and dimensioning of a reinforced concrete structure can be found in the corresponding manual entitled "Example of a reinforced concrete structure".

In summary, here are the basic steps that must precede the Pushover analysis:

1.1. Create a New Project



In the initial parameters select EC Greek and the corresponding materials will automatically be selected.

νικές Παράμε	τροι							2
Αλλες Παρά	ιμετροι Ο	θóv	n	Σχέδ	διο	Kauau	λπεικόνιση	
Γενικα	2 τοιχεια Εργου				niku	- NUVOV	ισμος	
Κανονισμός	EC						~	
Προσάρτημα	Greek						~	
Βιβλιοθήκη Σιδ	άρών Διατομών	E	uro		\sim	Metric	~	
Σκυρόδεμα			Мет	αλλικά				
Θεμελίωση	C20/25 ~		Μελη	- Στοιχε	ία	S275	(Fe430) 🗸	
Ανωδομή	C20/25 ~		Μετο	ιλλική Πλ	άκα	S275	(Fe430) 🗸	
			Κοχλί	ες		4.8	~	
Χάλυβας	DE000		Συγκα	όλληση		S275	(Fe430) 🗸	
Κύριος	BOUIC ~							
Συνδετήρες	B500C ~		Ξύλιν	α		C14	~	
-Συντελεστές	ς Ασφάλειας	v	мо	vM1		vM2	vM3	
Αστοχίας	Λειτουργικ.	1		1		1.25	1.25	7
үс 1.5	1	γ	M4	γM5		γM7		
γs 1.15	1	1		1		1.1]	
Г	OK	C	ancel		App	ly .	Help	

1.2. Modelling



Model, as usual, your vector using the relevant tools (dxf/dwg, standard constructions, draft, modelling), just as you would for a new construction.

1.3. Plates-Boards

3-1000.00	* 🛊 🖡 🌆 📼 🗆	cm) =			44
Βασικό	Μοντελοποίηση	Εμφάνιση	Εργαλεία	Πλάκες	Φορτία

Insert plates and loads, using the relevant tools.

1.4. Analysis



Run a first analysis of the structure using a Eurocode 8 scenario (static or dynamic).

Choose from the defaut scenarios and run the static or dynamic analysis, just like for a new construction, and create the combinations (predefined combinations).

E. Criteria for exemption from the structural adequacy inspection of existing buildings, according to Government Gazette 350/17-2-2016

The latest version of Scada Pro incorporates the criteria for exemption from the structural adequacy check of existing buildings, according to Government Gazette 350/17-2-2016.

ΚΡΙΤΗΡΙΑ ΑΠΑΛΛΑΓΗΣ ΣΤΑΤΙΚΗΣ ΕΠΑΡΚΕΙΑΣ

The exemption applies to additions, changes of use-conversions and their simultaneous combination. A prerequisite for the exemption is that the building must not

"evidence of significant structural deficiency" which are:

Obvious damage to the load-bearing structure or obvious serious design weaknesses such as:

- 1. Large cracks >0,4~0,5 mm
- 2. Significant reduction of reinforcement due to corrosion
- 3. Short columns without clamping in critical positions
- 4. Significant reduction of wall infill on adjacent floors (e.g. gantry) or very asymmetrical arrangement of wall infill in combination with lack of vertical elements with significant stiffness (risk of formation of a loose floor).

In addition, in the case of an addition, a prerequisite is:

"The structural design of the existing building has been carried out with "full provision for the addition", i.e. all floors of the addition have been included in the structural simulation of the existing building"

The course of action followed in the programme for the above cases is as follows:

The entity is entered as existing and an analysis scenario is selected for its analysis according to its original design. The strong scenarios in the program in this case are **seismic (EAK** and **old**)

and EC8 Greek (Static or Dynamic).

Then, the addendum is inserted and a new analysis scenario is created (this study as opposed to the original one) which is necessarily an EAK (Static or dynamic-et) or Eurocode 8 (Static or Dynamic).

The following option has been added to these scripts in their configuration dialog box:

ΚΡΙΤΗΡΙΑ ΑΠΑΛΛΑΓΗΣ ΣΤΑΤΙΚΗΣ ΕΠΑΡΚΕΙΑΣ

Selecting it displays the following

EXAMPLE 6: "STUDY FOR THE VALUATION AND REDESIGN OF A BUILDING ACCORDING TO THE CANC.

Κριτιρια Απαλλαγής Ε	λέγχου Στατικής Επάρκειας	×			
🗹 Κριτιρια Απαλλαγής	Ελέγχου Στατικής Επάρκειας ΦΕΚ. 350/17/2/20	16			
Είδος Επέμβασης	Προσθήκη 🗸				
Κατηγορία Κτιρίου	1 ~ ??				
Πρέπει για το τρέχ	ον σενάριο γi=1.0 και S=1.0 για εδάφη B,C				
Πρέπε	ι για το τρέχον σενάριο q = 2.3				
Δυσμενείς Συνέπειες	Δ1 ~ ??				
Στοιχεία Αρχικής Μελ	έτης				
Σενάριο Ανάλυσης	Seismic E.A.K. (Static) (0) $\qquad \lor$				
	Διάβασμα Στοιχείων απο Σενάριο				
Σπουδαιότητα	I ~ a 0 Vi 0				
	X Z				
Τέμνουσα Βάσης (kN) 0 0					
Εδαφικη επιτάχυνση (m/sec2) 0					
O	Cancel				

The check means that the checks will be done and the results will be presented in the Seismic Action printout.

Then we choose the type of intervention

- 1. Add
- 2. Changes of Use Conversions
- 3. At the same time both

Next, the category of the existing building (original design) is selected according to the table

Κατηγορίες Κτιρίων

Κατηγορία 1	Κτίρια που έχουν μελετηθεί με βάση τους Κανονισμούς της Ομάδας Α, έτσι όπως ισχύουν σήμερα				
Κατηγορία 2	Κτίρια που έχουν μελετηθεί με βάση ΝΕΑΚ/ΝΕΚΩΣ (1992), ΕΑΚ/ΕΚΩΣ (2000) ΕΝ1998-1, ΕΝ1992-1-1, ΕΝ1993-1-1, ΕΝ1994-1-1, ΕΝ1995, ΕΝ1996				
Κατηγορία 3	Κτίρια που έχουν μελετηθεί με τις "Πρόσθετες Διατάξεις του 1984", από Οπλισμένο Σκυρόδεμα και κατηγορίας σπουδαιότητας Ι ή ΙΙ.				
Κατηγορία 4	Οποιοδήποτε κτίριο				

This table is also displayed with ??

Under the building category, prompts are shown for parameter values of the current scenario (present study) according to the above GGC.

Πρέπει για το τρέχον σενάριο γi=1.0 και S=1.0 για εδάφη B,C Πρέπει για το τρέχον σενάριο q = 2.3

We then select the possible adverse effect in cases of change of use - conversion or a combination of both, according to the table below

ΠΙΘΑΝΕΣ ΔΥΣΜΕΝΕΙΣ ΣΥΝΕΠΕΙΕΣ

Δυσμένεια Δ1	Αύξηση κατακόρυφων φορτίων			
Δυσμένειες Δ2	Αύξηση μαζών και επομένως σεισμικών φορτίων			
Δυσμένεια Δ3	Αλλαγή στατικού συστήματος που φέρει οριζόντια φορτία			
Δυσμένεια Δ4	Δυσμενέστερη σεισμική απόκριση λόγω επιδείνωσης της μη-κανονικότητας λόγω αλλαγής τοιχοπληρώσεων			
Δυσμένεια Δ5	Αύξηση του συντελεστή σπουδαιότητας			

which is also displayed with ??

Next, we select the analysis scenario we ran in the first step for the initial study

Στοιχεία	Αρχικής	Μελέτης –

and press the

Σενάριο Ανάλυσης	Seismic E.A.K. (Static) (0)	~

Διάβασμα Στοιχείων απο Σενάριο

In the section below, the values of the quantities required for the checks are shown.

Σπουδαιότητα	I v	a	0.06	γi	1
		X		z	
Τἑμνουσα Βάσης (kN)		69.2	20183	69.22	0183
Εδαφικη επιτάχυνση (ι	m/sec2)	0.58	86	0.588	6

Then, after setting the parameters as known, we run the scenario for this study.

The results of the criteria are displayed with the "Seismic Action" button

ΚΡΙΤΗΡΙΑ ΑΠΑΛΛΑΓΗΣ ΕΛΕΓΧΟΥ ΣΤΑΤΙΚΗΣ ΕΠΑΡΚΕΙΑΣ ΥΠΑΡΧΟΝΤΟΣ ΚΤΙΡΙΟΥ (ΦΕΚ 350/17-02-2016)
Είδος Επέμβασης : Προσθήκη Κατηγορία Κτιρίου : 2 Κατηγορία Κτιρίου : 2 ΝΕΑΚ/ΝΕΚΩΣ (1992), ΕΑΚ/ΕΚΩΣ (2000), ΕΝ1998-1, ΕΝ1992-1-1, ΕΝ1993-1-1, ΕΝ1994-1-1, ΕΝ1995, ΕΝ1996
Στοιχεία Αρχικής Μελέτης : Seismic E.A.K. (Static) (0)
Σπουδαιότητα γi α αg,εx(m/sec2) αg,εz(m/sec2) Ve,ux(kN) Ve,uz(kN)
Σ3 1.15 0.16 1.1267 1.0621 129.98 122.53
Στοιχεία Παρούσας Μελέτης : EC-8_Greek Statickyrio (7)
Σπουδαιότητα γ1 α αg,nx(m/sec2) αg,nz(m/sec2) Vn,ux (kN) Vn,uz (kN)
Διεύθυνση X
ρα = 1.00 ρν/ρα = 1.58 Δεν απαλλάσσεται
$ \begin{aligned} \Delta(\epsilon \dot{\nu} \theta \nu \nu \sigma \eta \ Z \\ \rho &= \alpha g, n/\alpha g, \epsilon = 1.97 \\ \rho \alpha &= 1.00 \\ \rho/\rho \alpha &= 1.97 \\ \Delta \epsilon \nu \ \alpha \pi \alpha \lambda \lambda \dot{\alpha} \sigma \sigma \epsilon \tau \alpha \iota \end{aligned} $
$\rho v = Vn/Ve, u = 1.68$

ρα = 1.00 ρν/ρα = 1.68 Δεν απαλλάσσεται

They appear in the order:

- The type of Intervention selected, the category of the building (if it is only Add, no adverse consequence option appears).

- The data of the analysis scenario of the original study are then displayed, such as its name and the corresponding values of the quantities required. This is followed by the corresponding data of the current study (without a value in the Importance field because the Importance of the original building is always taken).

- Finally, there follow the checks that relate to either intersection reasons, or to ground acceleration design reasons. Checks are made in each direction and it goes without saying that the criteria for exemption must be met in both horizontal directions. The final criterion is expressed on a case-by-case basis as a final ratio which, if greater than one, is not exempt and, if less than or equal to one, is exempt.

1.5. Sizing

0	\$-1000.00	1100	m ·							USHAN	AA1 - Sa
۲	Βαφικό	Movialuituing	fugdinon	Epyphala	Philione,	Pepti	a Avalityons	Anomheop	ierra 🗌	bumana	köynan -
1	EC2	- 6	1 3		1	1	1 14	B	L	+	*
NED	Embao I	awigno Plapa- uctoor	Europat Bayer	 Anoncla- ty opame 	παράκτη- ροσμές *	Enliven	Λυγιάμος Έλεγχος Όπλιση *	Amureadul- dipartit *	EXCLUSION *	ARUTUG- CUOTE *	Endware Topsiv*
	Look	100	3040		Interesting the des	Grane	#tomplate	120	000	44-	Illes

Make a first dimensioning of the carrier using a **Eurocode 2** scenario in order to calculate its reinforcement.

- As mentioned before, a prerequisite for the execution of an inelastic analysis scenario is the existence of reinforcement in the cross-sections, which results from dimensioning ONLY with Eurocode 2 scenario (not with the old regulation) with adaptation of the strengths of the Steel and Concrete materials to the strengths of the existing structure.
- It is reminded that the materials to be used **must NOT be of B and STI quality** (old material grades) but the adjustments of strengths and individual safety factors must be made based on the new materials.

Within the Parameters of Sizing:

- select the combinations and
- adapt the strengths of the predefined materials to the qualities of your existing construction.

If the structure under inspection has **B** and **STI** quality materials, then in the definition of materials, in the sizing parameters, and before the initial sizing, you must define and modify the parameters of the materials per structural element <u>by adapting them to the characteristics of the new materials and modifying the strengths accordingly, based on the of the CEE.</u>

It is recalled that for the elastic analyses (checks in terms of forces - intensities) the representative (characteristic) strength value of the materials is the mean value minus one standard deviation, while for the inelastic analyses (checks in terms of deformations) and for the m method the representative (characteristic) strength value of the materials is the mean value. Method m is considered to belong, as far as the determination of strength is concerned, to the inelastic methods.

As mentioned above, the CEQS also provides for individual safety factors γm (γc and γs for concrete and steel respectively) which for existing materials are differentiated if the check is performed in terms of forces and if it is performed in terms of deformations and depend on the <u>data reliability level</u> (§ 4.5.3.)

Δνε Υψηλή	Ικανοποιητική	Ανεκτή
γ _m =1.15	γ _m =1.30	y_=1.45
(ίσχυ	ε και στη 2ª αναθεώρ	ησ η)
 Για Χάλυβα 	(ΣΑΔ _{ΥΧ}) - (Υλικό & /	Λεπτομέρ
ττς Υψηλή	Ικανοποιητική	Ανεκτή
Υψηλή	Ικανοποιητική ΣΑΔ _λ : «Υψηλή»	Ανεκτή
Υψηλή γ _m =1.05	Ικανοποιητική ΣΑΔ _Λ : «Υψηλή» γ _m =1.10	Ανεκτή γ _m =1.15
νκ Υψηλή γ _m =1.05 ΣΑΔ	Ικανοποιητική ΣΑΔ _Λ : «Υψηλή» γ _m =1.10 _Λ : «Ικανοποιητική»	Ανεκτή γ _m =1.15
Υψηλή γ _m =1.05 ΣΑΔ γ _m =1.10	Ικανοποιητική ΣΑΔ _Λ : «Υψηλή» γ _m =1.10 Λ: «Ικανοποιητική» γ _m =1.15	Ανεκτή γ _m =1.15 γ _m =1.20
Υψηλή Υψηλή Υ _m =1.05 ΣΑΔ γ _m =1.10	κανοποιητική ΣΑΔ _Λ : «Υψηλή» γ _m =1.10 _Λ : «Ικανοποιητική» γ _m =1.15 ΣΑΔ _Λ : «Ανεκτή»	Ανεκτή γ _m =1.15 γ _m =1.20

Έλεγχοι σε όρους παραμορφώσεων συντελεστές σταθεροί ανεξάρτητα από υλικό

LAΔv	Υψηλή	Ικανοποιητική	Ανεκτή
	γ _m =1.00	γ _m =1.10	y_=1.20

ΠΙΝΑΚΑΣ Π 4.1 : ΤΙΜΕΣ ΙΔΙΟΤΗΤΩΝ ΤΩΝ ΥΔΙΚΩΝ (που διαμορφώνουν τις αντιστάσεις) ΚΑΙ ΑΝΤΙΣΤΟΙΧΟΙ ΕΠΙΜΕΡΟΥΣ ΣΥΝΤΕΛΕΣΤΕΣ ΑΣΦΑΛΕΙΑΣ γ΄ m

2 C	MEGOAOL EAEI AOY							
	ΣΕ ΟΡΟΥΣ ΔΥΝΑ	ΣΕ ΟΡΟΥΣ ΠΑΡΑΜΟΡΦΩΣΕΩΝ ³						
	ΥΦΙΣΤΑΜΕΝΑ ΥΛΙΚΑ ⁶	ΠΡΟΣΤΙΘΕΜΕΝΑ		ΥΦΙΣΤΑΜΕ	ΠΡΟΣΤΙΘΕΜΕΝΑ			
		KANONI	IOM	NA YAIKA	KANONIEMOI			
1		Ναι Όγι			Nat	Ол		
Αντιπροσωπευτικές τιμές ⁵	X- s	Xk	Xk	x	x	x		
Επιμέρους συντελεστές ασφαλείας γ΄m ⁴	Για το σκυρόδεμα: Αναλόγως ΣΑΔγγζε = 1,30±0,15 Για τον χάλυβα οπλισμού: Για ΣΑΔΛ «Υγηλή» και αναλόγως	Αναλόγως διατομής ή / και προσπελασιμότητας		Αναλόγως Αναλόγως διατο ΣΑΔ _Υ ή / και προσπελασιμότι		διατομής ααι πιμότητας		
	$\begin{array}{c} \Sigma A \Delta_{Y} \ \gamma^{*}_{i} = 1.10 \pm 0.05 \\ \Gamma_{i\alpha} \Sigma A \Delta_{A} \ll Ixan order minstafy & kan analogo second staff and the second se$	γm•(1,05 ή 1,20)	Αυξημένοι	γ' _m =1,10±0,10	γ΄ _m =1,15 ή 1,25	γ΄ _m =1,15 ή 1,25		

Υφιστάμενες τοιχοπληρώσεις: γ_m=1,5 ± 0,2.
 Προστιθέμενες τοιχοπληρώσεις: γ_m=1,70 ÷ 3,00, βλ. ΕΚ 6.

The definition of the above parameters taken into account for the calculation of the strengths of the existing materials is carried out within the Sizing Parameters.

٠ In the initial window in the Active Sizing Material field: select Existing

Ικανοτικά	ός Κόμβων			Σιδηρών				Ξú	λινα	
Συνδυασμοί	Πλάκε	sς	∆окоі	Στύλ	01	Πέδ	ιλα		Οπλισμοί	
Συνδυασμοί Σετ Φ	ορτίσεων	(101)) Аот.	Λειτ.	+X	X	+Z		Z	No
Συνδυασμοί							1	∧/A	Κατά	^
1(5) +1.35Lc1+	1.50Lc2							A		
2(1) +1.00Lc1+	0.50Lc2						1	A		
3(2) +1.00Lc1+	0.30Lc2+1	.00Lc3+0.3	30Lc4+1.0	0Lc5+0.3	0Lc6+0	.30Lc7	1	A	+X	
4(2) +1.00Lc1+0	0.30Lc2+1	.00Lc3+0.3	30Lc4+1.0	0Lc5+0.3	0Lc60	.30Lc7	1	A	+X	
5(2) +1.00Lc1+0	0.30Lc2+1.	.00Lc3+0.3	30Lc4+1.0	0Lc50.3	0Lc6+0	.30Lc7	1	A	+X	
6(2) +1.00Lc1+	0.30Lc2+1.	.00Lc3+0.3	30Lc4+1.0	0Lc50.3	0Lc60	.30Lc7	1	A	+X	_
7(2) +1.00Lc1+	0.30Lc2+1	.00Lc3+0.3	30Lc41.0	0Lc5+0.3	OLc6+0	.30Lc7	1	A	+X	_
8(2) +1.00Lc1+	0.30Lc2+1	.00Lc3+0.3	30Lc41.0	0Lc5+0.3	0Lc60	.30Lc7	1	A	+X	_
9(2) +1.00Lc1+	0.30Lc2+1.	.00Lc3+0.3	30Lc41.0	0Lc50.3	OLc6+0	.30Lc7	1	A	+X	
10(2) +1.00Lc1-	+0.30Lc2+	1.00Lc3+0	.30Lc41.	00Lc50.3	30Lc6	0.30Lc7	1	A	+X	~
									2	•
Συντελεστές Στόθ	ίμης	1 /	(1- θ)						2	•
Συντελεστές Στάθ Στάθμη	λμης X	1/ Y	(1-θ) Z		Εισ	αγωγή Σ	ευνδι	υασμα	ς ών	~
Συντελεστές Στόθ Στάθμη 0 - 0.00)μης X 1.000	1 / Y 1.000	(1-θ) Z 1.000		Εισ Υπολ	αγωγή Σ ιογισμός	ευνδι ; Συνά	υασμα	ς νών νών	~
Συντελεστές Στάθ Στάθμη 0 - 0.00 1 - 300.00	θμης X 1.000 1.000	Y 1.000 1.000	ζ 1.000 1.000		Εισ Υπολ	αγωγή Σ ιογισμός	ευνδι ; Συνά	ιασμα δυασι	ς ήν που Λομ	· · · · · · · · · · · · · · · · · · ·
Συντελεστές Στόθ Στάθμη 0 - 0.00 1 - 300.00 2 - 600.00	θμης X 1.000 1.000 1.000	Y 1.000 1.000 1.000	Z 1.000 1.000 1.000		Εισ Υπολ Συνδυα	αγωγή Σ ιογισμός ισμός G+	ευνδι ; Συνά +ψ2Q	υασμα δυασι 2	ών μών 101	
Συντελεστές Στάθ Στάθμη 0 - 0.00 1 - 300.00 2 - 600.00	θμης X 1.000 1.000 1.000	Y 1.000 1.000 1.000	Z 1.000 1.000 1.000		Εισ Υπολ Συνδυα τόματη	αγωγή Σ ιογισμός σμός G- Διασταί	Συνδι ; Συνζ +ψ2Q πολό	υασμα δυασμ 2 [γηση	ών μών 101 Μελέτ	
Συντελεστές Στόθ Στάθμη 0 - 0.00 1 - 300.00 2 - 600.00	θμης X 1.000 1.000 1.000	Y 1.000 1.000 1.000	Z 1.000 1.000 1.000		Εισ Υπολ Συνδυα τόματη ναυπολ	αγωγή Σ ιογισμός σμός G-1 Διασταία	ξυνδι ; Συνά +ψ2Q πολό	υασμα δυαση 2 [γηση :θών	ών μών 101 Μελέτ KAN.E	<u>ר</u>
Συντελεστές Στάθ Στάθμη 0 - 0.00 1 - 300.00 2 - 600.00	θμης X 1.000 1.000 1.000	Y 1.000 1.000 1.000	(1-0) Z 1.000 1.000 1.000		Εισ Υπολ Συνδυα τόματη ναυπολ ένεργό	αγωγή Σ ιογισμός σμός G- ι Διαστασ ιογισμός Υλικό Δι	ευνδι ; Συνζ +ψ2Q πολό αστα	υασμα δυασ ? [γηση εθών σιολά	ών μών 101 Μελέτ ΚΑΝ.Ε	۲
Συντελεστές Στόθ Στάθμη 0 - 0.00 1 - 300.00 2 - 600.00	θμης X 1.000 1.000 1.000	Y 1.000 1.000 1.000	/ (1-θ) Z 1.000 1.000 1.000		Εισ Υπολ Συνδυα τόματη ναυπολ Ένεργό άμενο	αγωγή Σ ιογισμός σμός G- ι Διαστασ ιογισμός Υλικό Δι	ζυνδυ ; Συνί +ψ2Q πολό ; μεγε	υασμα δυασ ? [γηση εθών σιολά	ών μών 101 Μελέτ ΚΑΝ.Ε	
Συντελεστές Στόθ Στάθμη 0 - 0.00 1 - 300.00 2 - 600.00	θμης X 1.000 1.000 1.000	Y 1.000 1.000	Z 1.000 1.000 1.000	 Αυ Επα Υφιστ Νέο Υφιστ	Εισ Υπολ Συνδυα τόματη ναυπολ Ένεργό άμενο	αγωγή Σ ιογισμός σμός G-1 Διασταά ιογισμός Υλικό Δι	ξυνδι ; Συνζ +ψ2Q πολό αστα	υασμι δυασ ? [γηση σιολά	ών μών 101 Μελέτ ΚΑΝ.Ε	ישיא איז איז איז איז איז איז איז איז איז א

• In the fields Plates, Beams, Columns, Sheets, at the top, there is the choice of the corresponding materials:

Ικανοτικό	ς Κόμβων		Σιδηρών		Ξύλινα		
Συνδυασμοί	Πλάκες	Δοκοί	Στύλοι	Πέδιλα	Οπλισμοί		
Σκυρόδεμα : C1	2/15 Xà	λυβας (Κύριος)) :S220	Χάλυβας (Συνδ	δ/ρων) :S220		

Where,

choose the

quality of the material to be used for both concrete and reinforcement (main, connectors).

By selecting a different quality for the concrete, the corresponding coefficients are automatically updated.

The new version of SCADA Pro 21 added the possibility of simultaneous definition of two material qualities for the structural elements: new and existing.

OBSERVATIONS:

- In the existing material, the calculation of the final compressive strength is now done automatically based on the corresponding provisions of the CEE.
- Then, the attribution of the quality of the material to the elements and consequently their classification (New or Existing) is done automatically with their dimensioning and this information is now stored in each member resulting in the complete separation of new and existing elements, which gives great flexibility to the designer for further processing.
- All three windows (Concrete Steel main Connectors) are divided into two sections:
 - 1. NEW (left) &
 - 2. BACK (right)

The procedure is the same for all 3 windows.

You select a quality from the list and then, based on provisions of the EIA, you select from the corresponding fields in the "Calculation" section

Παράμετροι Σκυροδέματος		×
NEO Ποιότητα C20/25 Σταθερές Fck (MPa) 20 γcu 1.5 γcs 1 Fctm (MPa) 2.2 TRd (MPa) 0.25 Max Παραμορφώσεις εс (N,M) εc (N) 0.002	ΥΦΙΣΤΑΜΕΝΟ Ποιότητα C20/25 Σταθερές Fcd (MPa) 16.666666 γcu 1 γcs 1 Fctm (MPa) 2.210418 TRd (MPa) 0.25 Max Παραμοφώσεις εc (N,M) 0.0035 εc (N) 0.002	Υπολογισμός Ελεγχος σε όρους παραμορφώσει ~ Εργαστηριακές Τιμές ~ Πριν από το 1954 ΣΑΔ Υλικού Ανεκτή ~ Fcm (MPa) s (MPa) γ'c 20 4 1.2 Fck (MPa) Fcd (MPa) Fctm (MPa) 20 16.666666 2.210418
ΟΚ Εφαρ	ρμογή σε όλες τις κατηγορίες των (στοιχείων Cancel

the corresponding parameters of your study based on the provisions of the relevant paragraph of the CEE. Once the selections are complete, you press the "Update" button and the corresponding final strengths are indicated in the fields below the material and are the ones that will be used by the program.

The coefficients ycu and ycs must remain unity.

In detail:

📥 SKYRODEMA

You choose whether a calculation will be made:

- > in terms of Forces (Elastic analysis method q)
- ۶ in terms of Deformation (Elastic m & Inelastic method)

You cho	noose whether to set:	
	Fcm (N	1Pa) s (MPa)
	20	4
\mathbf{b}	Laboratory Values - to be filled in the fields	or
۶	In Absentia Prices (CANPE 2022) which also opens	the field of choice of date
	Πριν από το 1985	~
	Πριν από το 1985	
	logging Μετά ή το 1995	and automatically completes the
	fixed.	
(For	compatibility reasons, and the Abandoned	Prices of previous revision were retained.
The last	st option is the Material SDS:	
<i>P</i>	winay	
Þ	r Iconopoeia	
	High	
	1.2	

For	compatibility	reasons,	and	the	Abandoned	Prices	of	previous revision were retained.)

And it completes the

All other values are automatically filled in and the Update calculates the Constants for the Existing Concrete.

Παράμετροι Σκυροδέματος		×
ΝΕΟ Ποιότητα C20/25 Σταθερές Fck (MPa) 20 γcu 1.5 γcs 1 Fctm (MPa) 2.2 TRd (MPa) 0.25	YΦΙΣΤΑΜΕΝΟ Ποιότητα C16/20 ✓ Σταθερές Fcd (MPa) 10.83333 ycu 1 ycs 1 Fctm (MPa) 1.658632 TRd (MPa) 0.22	Υπολογισμός Ελεγχος σε όρους παραμορφώσει Εργαστηριακές Τιμές Γργαστηριακές Τιμές Πριν από το 1954 Ερήμην Τιμές (KANETIE 2017) Ερήμην Τιμές (KANETIE 2017) Ερήμην Τιμές (KANETIE 2017) Ερήμην Τιμές (KANETIE 2012) ΣΑΔ Υλικού Ανεκτή Γαν οπο το 1954 Εσί (MPa) s (MPa) γ'c 13 4 1.2 Εσί (MPa) Ecd (MPa) Ectm (MPa)
Max Παραμορφώσεις εc (N,M) 0.0035 εc (N) 0.002	Μαχ Παραμορφώσεις εc (N,M) 0.0035 εc (N) 0.002	13 10.83333 1.658632 Еvημέρωση Салсе

📥 HALYVAS:

Χάλυβας (Κύριων)			×
NEO Ποιότητα B500C Σταθερές Es (Gpa) 200 Fyk (MPa) 500 γsu 1.15 γss 1	ΥΦΙΣΤΑΜΕΝΟ Ποιότητα \$400s Σταθερές Es (Gpa) 200 Fyd (MPa) 333.3333 γsu 1 γss 1	Υπολογισμός Ελεγχος σε όρους παραμορφώσει ~ Οπτική αναγνώριση ~ Stahl I ~ ΣΑΔ Υλικού Ανεκτή ~ ΣΑΔ Λεπτομερ. Ανεκτή ~ Fym (MPa) s γ's	Εργαστηριακές Τιμές Ερήμην Τιμές (ΚΑΝΕΠΕ 2017) Οπτική αναγνώριση Ερήμην Τιμές (ΚΑΝΕΠΕ 2022) Εργαστηριακές Τιμές (ΚΑΝΕΠΕ 2022) Stahl I Stahl III Stahl III Stahl IV S220 S400 S500 B500
Μαχ Παρσμόρφωση εs 0.02	Μαχ Παραμόρφωση εs 0.02 Εφαρμογή σε όλες τις κατηγορίες τι	220 0 1.2 Fyk (MPa) Fyd (MPa) 220 183.3333 Ενημέρωση ων στοιχείων Cancel	

When determining the strengths of Steel (main & fasteners) there is the additional presence of **Optical Recognition**.



Selecting Visual Recognition opens the list of steel grades you select



EXAMPLE 6: "STUDY FOR THE VALUATION AND REDESIGN OF A BUILDING ACCORDING TO THE CANC.

All other values are automatically filled in and with the **Update** the Constants for the Existing Steel (main & fasteners) are calculated.

3^h revision of the EIA CIP

For steel, the material safety factor vs now depends not only on the material data reliability level but also on the detail data reliability level. These two new options have therefore been introduced:

Ανεκτή	~
Ανεκτή	~
	Ανεκτή Ανεκτή

The option Laboratory Values CANEPE 2022 was also introduced, where the cs is derived from a combination of the two SDSs and the option Absent Values CANEPE 2022 was also introduced where the requirement for steel is that the material SDS is satisfactory (rather than tolerable which was in the previous revision).

All other values are automatically filled in and with the **Update** the Constants for the Existing Steel (main & fasteners) are calculated.

Παράμετροι Σκυροδέματος		X
NEO Ποιότητα C20/25 Σταθερές Fck (MPa) 20 γcu 1.5 γcs 1 Fctm (MPa) 2.2 TRd (MPa) 0.25	ΥΦΙΣΤΑΜΕΝΟ Ποιότητα C20/25 Σταθερές Fcd (MPa) 16.666666 γcu 1 γcs 1 Fctm (MPa) 2.210418 TRd (MPa) 0.25	Υπολογισμός Ελεγχος σε όρους παραμορφώσει Εργαστηριακές Τιμές Πριν από το 1954 ΣΑΔ Υλικού Ανεκτή Fcm (MPa) s (MPa) γ'c 20 4 1.2 Fck (MPa) Fcd (MPa) Fctm (MPa)
Мах Параμορφώσεις εc (N,M) 0.0035 εc (N) 0.002 ОК Еq	Μαχ Παραμορφώσεις εc (N,M) 0.0035 εc (N) 0.002 ραρμογή σε όλες τις κατηγορίες των	20 16.66666 2.210418 Ενημέρωση στοιχείων Cancel

Finally, by selecting the "Apply to all categories of items" button,

the materials you specify for one category of building elements (e.g. Pillars) are automatically copied to all other categories of building elements and so you do not need to specify them again, provided of course that the qualities are the same.

Then and before the initial sizing, as in the new building, the corresponding option in the parameters must be "Existing". Then and as usual you adjust the reinforcements of the structural elements.

	Ικανοτικός Κόμβων		Σιδηρών			Ξύλινα				
Συνδυασμοί	Πλάκει	ς	Δοκοί	Σπ	ύλοι	Πέδ	ίλα		0	ιλισμο
ονδυασμοί Σετ	Φορτίσεων	(10)	1) Aσт.	Λειτ.	+X	X	+	Z	Z	No
Συνδυασμοί								Λ/A	Ka	rá ^
1(5) +1.35Lc1-	+1.50Lc2							A		
2(1) +1.00Lc1-	+0.50Lc2							A		
3(2) +1.00Lc1-	+0.30Lc2+1.0	00Lc3+0.	30Lc4+1.0	0Lc5+0.	.30Lc6+	0.30Lc7		Α	+X	
4(2) +1.00Lc1-	+0.30Lc2+1.0	00Lc3+0.	30Lc4+1.0	0Lc5+0.	.30Lc6	0.30Lc7		Α	+X	
5(2) +1.00Lc1-	+0.30Lc2+1.0	00Lc3+0.	30Lc4+1.0	0Lc50.	30Lc6+	0.30Lc7		Α	+X	
6(2) +1.00Lc1-	+0.30Lc2+1.0	00Lc3+0.	30Lc4+1.0	0Lc50.	.30Lc6	0.30Lc7		Α	+X	
7(2) +1.00Lc1-	+0.30Lc2+1.0	00Lc3+0.	30Lc41.0	0Lc5+0.	30Lc6+	0.30Lc7		Α	+X	
8(2) +1.00Lc1-	+0.30Lc2+1.0	00Lc3+0.	30Lc41.0	0Lc5+0.	30Lc6	0.30Lc7		Α	+X	
9(2) +1.00Lc1	+0.30Lc2+1.0	00Lc3+0.	30Lc41.0	0Lc50.	.30Lc6+	0.30Lc7		Α	+X	
10(2) + 1.00Lc	+0.30(-2+1)	001-010	0.001 - 4 4			-		-	1.14	~
	LI OIDOLCL I I	.00LC3+0	J. 30LC41	00Lc50	0.30LC6-	-0.30Lc7	·	A	+X	
<		.00103+0), 30LC41	00Lc5(0.30Lc6-	-0.30Lc7	' 	A	+,	>
< Ιυντελεστές Στά	ιθμης	1	/ (1-θ)	00Lc5(0.30LC6-	-0.30Lc7	, 	A	+X	>
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Στάθμη0 - 0.001 - 300.002 - 600.003 - 900.004 - 1200.005 - 1500.006 - 1800.00	θμης X 1.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000	1 Y 3.000 3.000 3.000 3.000 3.000 3.000 3.000	/ (1-0) Z 3.000 3.000 3.000 3.000 3.000 3.000 3.000 3.000	00Lc5(Εκ Υπο Συνδυ Αυτόματη παναυπο Ένεργά	-0.30Lc7 σαγωγή 1 λογισμός ασμός G- η Διαστα λογισμός • Υλικό Δ	ς Συνί ; Συ τψ2 σιολ ; μει	Α δυασ νδυα νδυα ε Q όγης φεθώ	μών σμών [101 τη Μελ ν ΚΑΝ	>
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With the command "Category - Beam Material" and "Category - Column Material" you can display the categorization of the elements and the strengths of the materials in your organisation.



For example, in the following beam spacing



there is the designation (Y), Existing material and the corresponding three characteristic strengths of concrete, main reinforcing steel and steel fasteners.

F. New data on the structural adequacy of arbitrary buildings, in the context of the implementation of the urban planning law 4495/2017

In the context of the implementation of the Planning Law **4495/2017**, which provides for cases where the existing building, **partly or entirely arbitrary**, is exempted from the structural adequacy test under certain conditions and cases where the structural adequacy test is required. In cases where structural re-inspection is required, **the following procedure shall be followed:**

A) Determination of the SDS

B) Complete geometric survey of the construction on site

C) Inspection for damage to structural members. If there are substantial damages (e.g. corrosion of reinforcements, carbonation of concrete, etc.) these are recorded and then the corresponding structural degradation factors are calculated based on the CEQA.

D) The following assumptions are made for the mechanical characteristics of the materials according to the selected **SDS**:

- for a satisfactory RMS, we define the values of the mechanical characteristics divided by yf=1,1

- for a high SWD, we define the values of the mechanical characteristics divided by

γf=1,0

- for a tolerable SWD, we define the values of the mechanical characteristics (Annex 3.1 of the CEE) divided by γf=1,2

and we do the sizing.

1.6. Modification and adaptation of the reinforcement

You will then need to modify and adjust this reinforcement according to the existing reinforcement of your structure, using the "Reinforcement Details" tools for beams and columns respectively.

In the Beam Reinforcement Details, the Main Opening Reinforcement section includes tools that allow you to modify the main reinforcement of the selected opening and the Reinforcement of Supports section includes tools to modify the reinforcement on the supports.



In addition, by activating the:



Half of the reinforcement of the lower openings shall be taken into account as oblique reinforcement, with the result that it is added to the supports and removed from the opening

After you have adjusted all the reinforcements of a beam or a row, you can use the **Copy** and **Paste** or **Paste All** commands, which allow you to copy the reinforcement of an opening to another opening (Paste) or to all openings of the row (Paste all).

C	Paste
Сору	Paste All
OBSERVATION:

A detailed description of the use and capabilities of the Beam Armour Detail tool can be found in the User Manual Chapter A: "Beam Armour Detail"

Similarly, in the Pillar Reinforcement Details, the Main Reinforcement section includes tools that allow you to modify the main reinforcement of the selected pillar or wall, and the Connectors section, tools to modify the connectors.



Then, after you have adjusted all the reinforcements of a column or wall, you can use the **Copy** and **Paste** commands, which allow you to copy the reinforcement of one column/wall to another (Paste), so that any modification you make to the cross-section of a column/wall can be copied to another column/wall, at the same or a different level, without having to repeat the process.



OBSERVATION:

A detailed description of the use and capabilities of the Beam Armour Detail tool can be found in the User Manual Chapter B: "Pillar Armour Detail"

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Scenario × Ονομα 1 2~~ EC2-EC3 Τύπος Νέο Ενημέρωση Διαγραφή Διαστασιολόγησης Σκυρόδεμα Συνδέσεις 🔄 Σιδηρά Εφαρμογή Συνολικός Οπλισμός Κτιρίου Αποθήκευση Εισαγωγή Έξοδος Συνολική Διαγραφή Ενισχύσεων Δοκών Στύλων

Within the NEO field there is now the possibility to store the total armament

	Συνολικός Οπλισμό	ς Κτιρίου			
of the building	Αποθήκευση	Εισαγωγή	as we	ell as to delete in	total all the
		-Συνολική Δ	ιαγραφ	ή Ενισχύσεων	
reinforcement	of beams and poles	Δοκών		Στύλων	

With the Total Building Reinforcement field, it is possible to store the reinforcement of the beams and columns with the manual modifications made by the user in order to adjust the reinforcement of an existing design for the purpose of evaluation and redesign, as well as the reinforcements given to these elements.

This command is very useful in cases where there is a need to remove, modify or add a new item.

PROCEDURE:

In these cases select Save, then return to modeling, make the modifications to the vector, run the original EC8_Greek analysis (Static or Dynamic) and come back to dimensioning. You load the combinations again and re-dimension the entire vector to pick up reinforcements and new or modified elements. By selecting the Insert command, all the rebars and any reinforcements that you manually inserted into the pre-existing elements are brought back in. It now remains to insert the existing reinforcements into the new or modified elements.

1.8. Interaction Diagrams

1.8.1. Strength calculation (Pushover)

After the preliminary procedure is completed and the existing reinforcement is inserted in all elements of the structure, and before the creation of the pushover analysis scenario, <u>it is necessary to precede</u> the "Pushover Strength Calculation" by selecting the corresponding command:

"Dimensioning">"Columns">"Results">"Pushover calculation"

Or alternatively for all elements of the study via the command:

"Sizing">"Parameters">"Recalculation of SIZE">"

Ικανοτικός Κόμβων Σιδη						δηρών Ξύλ			ϋλινα	
Συνδυασμοί	Πλάκ	ες	Δοκοί	Στύ/	Лог	Пέδ	ίλα		On	λισμοί
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4(2) +1.00Lc1	+0.30Lc2+1	.00Lc3+0.	30Lc4+1.0	0Lc5+0.3	0Lc60	.30Lc7	A		+X	
5(2) +1.00Lc1	+0.30Lc2+1	.00Lc3+0.	30Lc4+1.0	0Lc50.3	0Lc6+0	.30Lc7	A		+X	
6(2) +1.00Lc1	+0.30Lc2+1	.00Lc3+0.	30Lc4+1.0	0Lc50.3	0Lc60	.30Lc7	A		+X	
7(2) +1.00Lc1	+0.30Lc2+1	.00Lc3+0.	30Lc41.0	0Lc5+0.3	0Lc6+0	.30Lc7	A		+X	
8(2) +1.00Lc1	+0.30Lc2+1	.00Lc3+0.	30Lc41.0	0Lc5+0.3	0Lc60	.30Lc7	A		+X	
9(2) +1.00Lc1	+0.30Lc2+1	.00Lc3+0.	30Lc41.0	0Lc50.3	0Lc6+0	.30Lc7	A		+X	
										h d
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10(2) +1.00Lc < ωντελεστές Στά Στάθμη 0 - 0.00 1 - 300.00 2 - 600.00	1+0.30Lc2+ άθμης X 1.000 1.000 1.000	1.00Lc3+0 1 Y 1.000 1.000 1.000	/ (1-0) Z 1.000 1.000 1.000	00Lc50.	30Lc6 _Greek Εισ Υπολ	0.30Lc7 Dynami αγωγή 2 ιογισμός Επα	7 Α c (1).c Συνδυα ; Συνδι I Calc +ψ2Q	mb ogua uag	+x ών μών 101	> ``
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10(2) +1.00Lc < τυντελεστές Στα Στάθμη 0 - 0.00 1 - 300.00 2 - 600.00	1+0.30Lc2+ δθμης X 1.000 1.000 1.000	1.00Lc3+0 Y 1.000 1.000 1.000	/ (1-0) Z 1.000 1.000 1.000	00Lc50.	30Lc6 _Greek Εισ Υπολ Συνδυα πόματη ναυπολ Ξνεργό	-0.30Lc7 Dynami αγωγή 3 κογισμός Επα ισμός G- ι Διαστα κογισμός Υλικό Δ	 Α (1).c Συνδια Συνδια Συνδια Συνδια Ταικοί <l< td=""><td>mb οσμα υασ ηση θών</td><td>+Χ ών μών 101 ι Μελε ΚΑΝ.</td><td>> ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~</td></l<>	mb οσμα υασ ηση θών	+Χ ών μών 101 ι Μελε ΚΑΝ.	> ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~
10(2) +1.00Lc < Στάθμη 0 - 0.00 1 - 300.00 2 - 600.00	1+0.30Lc2+ δθμης X 1.000 1.000 1.000	1.00Lc3+0 1 Y 1.000 1.000 1.000	/ (1-0) Z 1.000 1.000 1.000	00Lc50.	30Lc6 Greek Εισ Υπολ Συνδυα πόματη ναυπολ Ξνεργό rόμενο	-0.30Lc7 Dynami αγωγή 3 ιογισμός Επα ισμός G- ι Διαστα ιογισμός Υλικό Δ	 Α (1).c Συνδια Συνδια Συνδια Ταις Ταις	mb ລວມດ ມດວງ (ທຸດຖ ອີພັນ ຄີດີດີດີດີ	+χ ών μών 101 Ι Μελε ΚΑΝ.	>

Through this command, the program calculates the M-N interaction diagrams for all structural elements of the beam

Επαναυπολογισμός μεγεθών ΚΑΝ.ΕΠΕ.

and all levels.

Alternatively, the recalculation of the strengths after manual modification of the reinforcement for the beams and/or columns/wall and all levels, the corresponding options can be found in the Results of Beams and Columns:

		SCADA Pro 328it - (10)	Scada : 0-0.00 (d\meletes\222
δοσικό Μοντελοποίηση Εμφάνιση Επιδεργασί	e tyyalitia Maett Coptia	Ανάλωση Αποτελέσματα Δισστασιολόγησ	n Dullánomal Ripéal
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ικ Κόμβοι μ Μελη δοκών μ] Μελη στύλων		DerxocKaudwr +	Iovolasi

It involves the calculation and display of the moment-axial interaction diagrams, based on the geometry of the crosssection, the quality of the materials and the reinforcement. The three-dimensional diagram of the strength envelope (My, Mz, N) is produced. In addition, the Tension-Deformation diagrams for steel and concrete are displayed schematically, and the Stress-Curvature diagram is shown in detail.

Conservation: The points inside the diagram are the N-My-Mz points each combination.

Select the calculation for the Pillars and/or Vault or Beams, per Floor or for the whole Building. The program automatically calculates the interaction diagrams, while the diagrams are displayed on your screen.

In addition, for the individual element (beam or column/column), it is possible to calculate its new strengths through the Reinforcement Details.



1.8.2 Recalculation of the figures of CAN.Ltd.

In addition, the **Επαναυπολογισμός μεγεθών ΚΑΝ.ΕΠΕ.**, allows the recalculation of the strength moments in case of <u>modification of the materials</u> in the Beam-Pillar fields, and if the reinforcement has already been modified according to the existing situation.

So if, for example, you have already defined the existing strengths of your materials, you have already dimensioned your design and modified the reinforcements of the structural elements and then you need to modify the strengths of your materials, you only need to make the change

and press the button Enavounoλογισμός μεγεθών KAN.EΠE. to recalculate all the sizes provided for by the EIA without having to repeat the procedure. The program will automatically calculate the new sizes for all members of the study.

2°STEP 2: PREVENTION

2. Foreword

In the option to create scenarios and select the type of analysis "EC8_Greek", there are the following types of analysis scenarios:

EC-8_Greek 🔻
Προέλεγχος Static 🔫
Static
Dynamic
Ανελαστική
Ελαστική Static
Ελαστική Dynamic
Προέλεγχος Static
Προέλεγχος Dynamic

The types:

- Static
- Dynamic

They are used for the analysis of new buildings based on EC8 and the Greek national Appendices.

All the following types:

- Anelastic
- Elastic Static
- Elastic Dynamic
- Static pre-testing
- Dynamic pre-testing

They are used for the assessment and redesign of existing structures based on the provisions of the C.E.P.E.

2.1 Introduction

The two types of analysis scenarios "Static" and "Dynamic" are two preliminary elastic analyses in order to examine whether the criteria set by the CEE for the application of elastic (static or dynamic) analysis for the assessment and redesign of the structure are met. In particular, among other things, the inadequacy indices " λ " are calculated, which give a first picture of the earthquake resistance of the building (CEE §5.5.1.1). The morphological regularity of the building is also examined (CEE §5.5.1.2).

OBSERVATION:

For performance level A, the following elastic analyses may be applied (static and dynamic) without conditions (§5.5 and §5.6)

EPC 5.5.1.1.1 Structural element failure index

In order to determine the magnitude and distribution of the inelastic behaviour requirements in the primary loadbearing structures elements of the structure bearing the seismic actions, a preliminary elastic analysis of the building is required in order to calculate for each of its elements the ratios ('indices of inadequacy') $\lambda = S / Rm_{p}$ (5.1)

where S is the intensive magnitude (moment) due to the actions of the seismic combination (§4.4.2), where the seismic action is taken without reduction (the elastic spectrum of EC 8-1 is used), while $_{Rm}$ is the corresponding available resistance of the element, calculated the basis of the average values of the strengths of the materials (see §5.1.4).

The λ ratios will be calculated, both for valuation and for redesign, on each primary load-bearing element. The highest λ ratio for an individual element on a floor (the most overloaded) will be considered a critical λ ratio for the floor.

CAN.EPE 5.5.1.1.2 Morphological regularity

The scope of each method mentioned in §5.1.1 depends on the morphological characteristics of the building, which influence its behaviour under seismic actions. The building is considered to be morphologically normal when the conditions listed in EC 8-1 are met.

The CEE prescribes specific requirements for the application of Elastic Statics and Elastic Dynamics analysis:

In addition, the EIA sets conditions for the application of the pushover analysis, which in order to be applied, the influence of the upper eigenmodes must not be significant (EIA §5.7.2 (b) INFLUENCE OF THE UPPER PROPERTIES) (see.

§Control of the influence of the higher idioms)

EPC 5.5 For performance level A, the elastic static analysis may be applied without the conditions in § 5.5.2.

EPE 5.5.2 Conditions of application (Elastic static analysis)

For the elastic methods there is no question of conditions of application relating to the level of confidence in the data.	α. The application of the static elastic method is permitted (for performance levels B or C, see § 5.5) when all of the following conditions are met:
	(i) For all the main elements λ≤2.5, or for one or more of them λ>2.5 and building is morphologically normal.
	(ii) The fundamental eigenperiod of the building $_{\tau_0}$ is less than 4 $_{\tau_c}$ or 2s, (see EC 8-1).
As Criterion of this of	(iii) The ratio of the horizontal dimension in a
aperture not is	floor not exceeds the 1.5

deformable, the rule may be used that the relative floor arrow on either side of the building shall not exceed 150% of the through the relative arrow.	(except	o ani	last nexes).	floor	and
As a criterion for this condition, the rule may be used that the average relative arrow of a floor (excluding appendages) shall not exceed 150% of the relative arrow of the underlying or the floor above.	(iv) The building distribution of sti	doe ffnes	es not exhib ss in plan vie	bit a strongly c ew on any floor.	nsymmetrical

No required check of this treaty on sufficient mixed systems.	 (i) the building in sectional height does not exhibit an asymmetrical distribution of mass; or of stiffness.
	(ii) The building has a system for absorbing seismic actions in approximately two vertical directions addresses between them.
The main objectives of this paragraph are, on the one hand, to prevent the exclusion of the method (which has the well-known advantages of simplicity and transparency), due to the fact that all the conditions application of the §5.5.2a , particularly in older buildings, and the possibility of using the same method of analysis both in assessment and in the redesign (in which case, because of the interventions, it is more likely the conditions for application will be met).	β. Notwithstanding the validity of conditions i, iii, iv and v of the previous paragraph, but that there is no substantial damage, the static elastic method may be used for the purpose of valuation (only). In this case the simulation safety factors _{ysa} provided for in § 4.5.1 shall be increased by 0,15.

CAN.EPE 5.6.1

Conditions of application (Elastic Dynamic Analysis)

For the elastic methods there is no	α . The scope of the dynamic elastic method is defined by the
question of conditions of	condition that for all principal elements $\lambda \le 2.5$. or for one or
application relating to the level of	more of them λ > 2.5 and the
confidence in the data.	building is morphologically normal.

 For the purposes of this provision b. Regardless of the validity of the conditions of the possibility see the comments of previous paragraph, but under the provided that there is no substantial damage, the dynamic elastic method may be used for the purposes of assessment (only). In this case the safety factors of the simulation csd provided for in § 4.5.1 shall be increased by 0,15.

In the following, the procedure, parameters and results of the controls of the "Pre-test" scenario in SCADA Pro are analyzed.

The CANEP requires that certain criteria be met in order for the flexible methods to be applied.

- For the Elastic Static Analysis it provides a set of criteria (including morphological regularity) of which have been implemented in the project and are presented in the form of controls, those of which contain quantitative quantities and could be
- implemented computationally.
 For the Elastic Dynamic Analysis the only criterion set by the CEFR is that the inadequacy index λ is less than or equal to 2.5 (λ≤ 2.5) or for one or more of these λ > 2.5 and the building is morphologically normal.
- However, for both methods, it gives the possibility to apply the elastic methods, <u>for valuation only</u>, as long as the coefficient of the permanent loads ysd is increased by 0.15.

4.5.1d) Also, according to Chap. 5, and as far as elastic analysis, static or dynamic, is concerned, its application is only permitted for valuation purposes, irrespective of the validity of the conditions of application (see §§ 5.5.2.b and 5.6.1.b), if the cSd coefficients in this

§ 4.5.1 are increased by 0.15 (i.e. **γSd,ελ.= γSd+ 0.15**).

In the analysis section, you can now define a preliminary analysis scenario (pre-check), either static or dynamic, which will be run with an <u>elastic spectrum</u> and will perform all the checks for the analysis selection criteria, based on what was mentioned above.

A prerequisite for the execution of the preliminary analysis scenario is:

- $\sqrt{}$ the existence of armaments; and
- $\sqrt{}$ the calculation of the corresponding strength moments.

2.2 Pre-check

So in the analysis section and in the "New Scenario" option

Επαναρίθμηση				
Kóμβων Cuthill-McKee(II)	•			
🕅 Ακύρωση	Ονομα			
EC-8_Greek Προέλεγχος Statio EC-8 Greek Ελαστική Static	Ανάλυση	EC-8_G	reek	•
	Τύπος	Προέλε	yxoç Static	
	Ιδιότητες Μέλι Φορτία	Static Dynamic Ανελασ Ελαστικ Ελαστικ	ະ ການຖ໌ ຖ໌ Static ຖ໌ Dynamic ແທດ Static	
		Προέλε	γxoç Dynam	ic
	Néo		Ενημέρωα	ση
		FEoð	00	_

create a new script "Static Pre-Control" or "Dynamic Pre-Control"

1. Note that for this scenario, the stiffnesses of the elements are adjusted based on Table C4.1 of CANEPE.

A/A	Δομικό στοιχείο	Δυσκαμψία
1.1	Υποστύλωμα εσωτερικό	0,8*(EcIg)
1.2	Υποστύλωμα περιμετρικό	0,6*(EcIg)
2.1	Τοίχωμα, μή - ρηγματωμένο	0,7*(EcIg)
2.2	Τοίχωμα, ρηγματωμένο (1)	0,5*(EcIg)
3	Δοκός (2)	0,4*(EcIg)

Πίνακας Σ 4.1: Τιμές δυσκαμψίας

You then follow the procedure for running the script.

In the "Parameters" dialog box you set the parameters as you would for an EC8 scenario:

Παράμετροι EC8		×		
Σεισμική Περιοχή Σεισμικές Περιοχές Ζώνη Ι ν ^a 0.16 *g a (KAN.EΠΕ.) 0.16 *g Σπουδαιότητα Ζώνη ΙΙ ν Υ ⁱ 1	Χαρακτηριστικές Περίοδοι Τύπος Φάσματος Οριζόντιο Κατακόρ. Τύπος 1 S,avg 1.2 0.9 Εδαφος TB(S) 0.15 0.05 Β TC(S) 0.5 0.15 TD(S) 2.5 1	Enineδa XZ εφαρμογής της σεισμικής δύναμης Κάτω 0 - 0.00 Avω 2 - 600.00 Δυναμική Ανάλυση Ιδιοτιμές 10 Ακρίβεια 0.001 CQC Συντελεστές Συμμετοχής Φάσματος Απόκρισης PFx 0 PFy 0 PFz 0		
Φάσμα Φάσμα Απόκρισης Ελαστικά ζ(%) 5 Οριζ Φάσμα Απόκρισης Ενη Είδος Κατασκευής q Σκυρόδεμα ~ qx Τύπος Κατασκεύης Χ Σύστημα Πλαισίων	Κλάση Πλασημότητος DCM όντιο b0 2.5 Κατακόρυφο b0 3 μέρωση Φάσματος Sd(T) >= 0.2 a*g 1 qy 1 qz 1 z Σύστημα Πλαισίων	Εκκεντρότητες Sd (T) e τιχ 0.05 *Lx e τιz 0.05 *Lz e τιz 0.05 *Lz Avoiγματα Εσοχές X ενα Z ενα Z χνα		
Ιδιοπερίοδοι Κπρίου Χ Δύσκαμπτα χωρικά πλαίσια από Σκυρόδεμα Μέθοδος Υπολογισμού Χ Δύσκαμπτα χωρικά πλαίσια από Σκυρόδεμα Ιδιομορφική Ανάλυση Ζ Δύσκαμπτα χωρικά πλαίσια από Σκυρόδεμα Οριο Σχετικής Μετακίνησης ορόφου 0.005 Χαρακτηρισμός Σεισμοπλήκτων Τοιχεία ΚΑΝΕΠΕ Default ΟΚ Cancel Είδος Κατανομής Τριγωνική ΚΡΙΤΗΡΙΑ ΑΠΑΛΛΑΓΗΣ ΕΛΕΓΧΟΥ ΣΤΑΤΙΚΗΣ ΕΠΑΡΚΕΙΑΣ				

The response range for pre-testing shall be elastic.

In this box a new button has been added where in the dialog box that appears, you set (as in inelastic):

Παράμετροι Ελαστ	Παράμετροι Ελαστικής 🛛 🗙				
🗹 Υπολογισμός στο	αθερής τιμής μήκους δι	άτμησης LS	s		
Στάθμη Αξιοπιστία	ις Δεδομένων				
Γεωμετρίας	Ικανοποιητική		\sim		
Υλικού	Ικανοποιητική		\sim		
Λεπτομερειών	Ικανοποιητική		\sim		
Εκταση Βλαβών γ Εντονες & Εκτετα	ια τον υπολογισμό του αμένες Βλάβες-Επεμβά	γSd (Σ.4.2 σεις	2)		
Συντελεστής επαί	Συντελεστής επαύξησης γSd 0				
Μέθοδος Υπολογι	Μέθοδος Υπολογισμού - Ανάλυσης / Επιτελεστικότητα				
			\sim		
🗌 Επούξηση (m),	(q) §5.7.2 (β)	25	%		
Τιμές του δείκτη α	τυμπεριφοράς q'				
			\sim		
			\sim		
			\sim		
ОК	ΦΑΣΜΑΤΑ	Can	cel		

OBSERVATION:

Especially for the pretest scenario, the choice of ow to calculate the shear length Ls does not affect he results.

me ena nom me worst sus between materiar and details.

So in the four scenarios of the elastic analysis CANPE, in the dialogue box displayed by the CANPE button, all three SADs are now displayed



Select:

Ικανοποιητ	пкή
Ανεκτή	
Υψηλή	

- For each **Data Reliability Level**

- The Extent of Damage The csd factor is automatically calculated based on corresponding option,

Εντονες & Εκτεταμένες Βλάβες-Επεμβάσεις	
Ελαφρές & Τοπικές Βλάβες-Επεμβάσεις	
Χωρίς Βλάβες & Χωρίς Επεμβάσεις	
	_

The value 0 in the field

Συντελεστής επούξησης γSd	0	
Συντελεστής επαύξησης γSd	0	

means that the coefficient will take the value based on table .4.2. of the EIA.

If you want your own value, enter a number and it will be <u>added up</u> to the value provided by the table. Calculations are made based on the resulting sum.

Where more precise data are not available, cSd values according to following Table may be used.

Table S 4.2: Values of the cSd coefficient

Intense and extensive damage and/or interventions	Light and localised damage and/or interventions	Without damage and without interventions
$_{\rm vSd} = 1,20$	$_{\rm vSd} = 1,10$	$_{\rm vSd} = 1.00$

See. See also Annex 7D on damage and deterioration.

Then, select the command FRAME

The EIR provides a minimum tolerable target based on the building's significance category based on the table below:

Κατηγορία Σπουδαιότητας	Ελάχιστοι Ανεκτοί Στόχοι
Ι	Г2
II	Г1
III	B1
IV	B1 και A2 (Ικανοποίηση και των δύο στόχων)

Πίνακας ΠΑ.2.1. Ελάχιστοι ανεκτοί στόχοι αποτίμησης ή ανασχεδιασμού υφισταμένων κτιρίων.

Σε κάθε περίπτωση να θεωρηθεί ότι ισχύει A1>A2, B1>B2, Γ1>Γ2, A1>B1>Γ1 και A2>B2>Γ2

3^h revision of the 2022 EIA.

In the new EIA, more seismic hazard categories are introduced (9 in total from 2 before), the term *seismic class* is introduced, as well as a new method of assessment and redesign (which can be followed as an alternative to the one in force until now).

Seismic class is the maximum rating or redesign target for a given level of performance. It is derived from the combination of performance level and αg rate.

The seismic classes for performance level B are considered as basic seismic classes.

Περίοδος Επαναφοράς (έτη)	Πιθανότητα υπέρβασης σεισμικής δράσης εντός του συμβατικού χρόνου ζωής του 50 ετών	ag lag.ref
2475	2%	1.80
975	5%	1.30
475	10%	1.00
225	20%ä	0.75
135	30%	0.60
70	50%	0.45
40	70%	0.35
20	90%	0.25
<20	>90%	<0.25

Πίνακας Σ 2.1. Ενδεικτική συσχέτιση περιόδου επαναφορός και πιθανότητας υπέρβασης της σεισμικής δράσης με την αντίστοιχη ανηγμένη οριζόντια εδαφική επιτάγινου.

Στον Πίνακα 2.1 παρουσιάζεται, η συσχέτιση της στάθμης επιτελεστικότητας του φέροντος οργανισμού με την αντίστοιχη ανηγμένη ορέζονται εδαφική επιτάχυνση. Στον Πίνακο Σ 2.1 παρουσιάζεται, μια ενδεικτική συσχέτιση της περιόδου επαναφοράς και της αντίστοιχης πίθανότητας υπέρβασης εντός του συμβατικού χρόνου ζωής τον 50 ετών της σεισμικής δράσης με την αντίστοιχη ανηγμένη οριζόνται εδαφική επιτάχυνση.

Πίνσκας 2.1	Στόχοι αποτίμησης	ή ανασχεδιασμοι	ύ Φέροντος Οργανισμ	ioù
-------------	-------------------	-----------------	---------------------	-----

	Στάθμη Επιτελει	στικότητας Φέροντ	ος Οργανισμού
ag /agsef	Α «Περιορισμένες Βλάβες»	Β «Σημαντικές Βλόβες»	Γ «Οτοιτεί Κατόρρευση»
1.80	A0	BO	FO
1.30	Al?	B1	THE .
1.00	AL	B1	- FI
0.75	A2	827	121
0.60	A2	812	12
0.45	A3*	B3+	13
0.35	A3	B3	13
0.25	Λ4*	B4	14
<0.25	A4	B4	14

 α_{g.ref} είναι η οριζόντια εδαφική επιτάχυνση αναφοράς, που ορίζεται με πιθανότητα υπέρβασης της σεισμικής δράσης 10% στα 50 χρόνια συμβατικής ζωής του έργου.

α_g είναι η οριζόντια εδαφική επιτάχυνση.

δ. Σεισμική κλάση κτιρίου ορίζεται ως ο μέγιστος στόχος αποτίμησης ή ανασχεδιασμού που μπορεί να εξασφαλίσει ένα κτίριο για μια επιλεγείσα στάθμη επιτελεστικότητας. Η σεισμική κλάση κτιρίου για στάθμη επιτελεστικότητας Β («Σημαντικές Βλάβες») θεωρείται βασική σεισμική κλάση.

Based on the above table we can summarize that my level of performance determines m, q (elastic) and θ u (inelastic) and my return period and exceedance probability determines the seismic acceleration α g.

The three valuation targets (or the three seismic classes) for a 10% earthquake are still called A1, B1, C1 and have a factor of one but the targets for a 50% earthquake are now called A3+, B3+, C3+ and have a factor of 0.45 (from 0.53 previously). Still the two basic seismic hazard categories are no longer 10% and 50% but 10% with a factor of 1 and 30% with a factor of 0.60 (the two lines in bold in the table).

In the parameters of the 5 scenarios related to EIS there is now a new field for the ground acceleration that will be calculated and used based on the above table.

Going to the framework

We select the seismic hazard category with the corresponding triad of seismic classes and the factor by which the initial reference ground acceleration will be multiplied in order to obtain the ground acceleration of the CANEPE λάσματα ×

Στόχοι αποτίμησης ή ανασχεδιασμού Φέρον	τος Οργανισμού	A1 B1	Г1	1.00	~
		A0 B0	ГО	1.80	
ζωά αγεδιασμού (έτα) 50 🗸	F	A1+B1	+ F1+	1.30	
		A1 B1	Γ1	1.00	
Περιορισμένες Βλάβες (Α - DL)		A2+B2	+ F2+	0.75	
		A2 B2	Γ2	0.60	
Εδαφική επιτάχυν	'ση ag=AgR.γI.(TF	A3+B3-	+ F3+	0.45	
Υπολογισμός TR	Υπολογισμός ΤL	A3 B3	Γ3	0.35	
- 15 1 (1 > 475		A4+ B4	+ Г4+	0.25	
Περιούος επαναφορας TR (έτη) 475	Πιθανότητα υπέρ	A4 B4	Γ4	<0.25	

or the default 10% or 30% which automatically sets the Target:

Φάσματα	×	Φάσματα
Στάχοι αποτίμησης ή οινοσχεδιοσμού Φέροντος Οργανισμού 👫 Β1 Γ1	1.00 😪	Στόχοι ατοτίμησης ή ανασχεδισαμού Φέροντος Οργανισμού 🗛 82 F2 0.60 🗸
Zwh gystiogui (1) (itm) 50 v ExBiting k (3.0)	3	Zwij nyslonskou (km) 50 v Gran Skiller (A. D.)
EDevice EDevice EDevice EDevice EDevice Tebovicule Transaucule TR	0.24	EXeryade Edopen's configurate agr AgR.y1.(TR/TLR)1A 0.144 YanAveraule: TR YanAveraule: TR
Περίοδος επαναφοράς Τ.Κ. (έπη) 475 Πιθονότητα υπέρβοσης PLR %	10	Περίοδος επαναφοράς Τ.Κ. (έτπ) 135 Γιθονότητα υπέρβασης PLR % 10
Πθανάτητο υπέρβασης PR % 00 Περίοδος επανοφοράς TUR (έτη)	475	Πιθανότητα υπέρβασης PR16 30 Παρίοδος επανοφορός TLR (έτη) 475
Σημαντικός Βλάβες (Β - 50) Ε Ελεγχος Εδαφική επτάχυνση αφηλίβθ, γί. (ΤΡ./Τ.Ρ.) 1/k Υπολογισμός ΤΒ Υπολογισμός ΤΙΒ	0.24	Σημαιτικός Βλάβες (Β - 50) Εξλαγχαίς ξόσφική επητόχενιση ag=AgR.γt.(TH/TLR)1/k 0.144 Υπολογοποίο TR Υπολογοτικός TLR
Περίοδος επαναφορός ΤΡ. (έτη) 475 Πιθανότητα υπέρβασης Ρ.Ε.Υ.	10	Περίοδος επαναφοράς Τ.Κ. (έπη) 135 Πιθανόπητα υπέρβασης ΡLR % 10
Πθανάτητα υπέρβασης PR % 20 Περίοδος επαναφοράς ΤLR (έτη)	475	Πθανότητα υπέρβασης PR% 30 Παρίοδος επαναφορός ΤLR (έτη) 475
Oravel Karrdappeurgn (F - NC)		Oravsi Kandapeum (F - NC)
Εδασική επιτόχυνση σχι-λαβ.γέ.(TR/TLR) ()k Υπολογισμός TR Υπολογισμός TR	0.24	Ελεγχος Εδαφική επτόχυνση eg=AgR.γL (TR/TLR) 1/k 0.144 Υπολοχισμός TR Υπολοχισμός TLR
Περίοδος επαναφορός Τ.R. (έπι) 475 Πιθανότητα υπίρβασης PLR %	10	Περίοδος επαναφοράς ΤR (έm) 125 Πιθανάτητα υπίρβασης PLR % 10
Πθανότητα υπέρβασης PR % 20 Περίοδος επαναφοράς TLR ((tm)	475	Πθανότητα υπέρβασης PR% 30 Περίοδος εποναρορές TLR (έτη) 475
Tpocalioyi KANETE 10% KANETE 10% KANET KANET CK Cancel	3 22%	Tpocnkoyi KANETE 1974 KAAET KAAET CK Cancel

and returning to the initial parameters of the scenario in the field of ground acceleration CAN.EPE.

Σεισμικές Πε	ριοχές	
Zώνη II 🗸 a	0.24	*g
a (KAN.ERE.)	0.144	*g

we see the value of the ground acceleration as it was calculated previously and as it will be used in the execution of the scenario for the calculation of the seismic action.

It is also noted that the yi used for the calculation of the seismic action always becomes 1 (from 0.8 which was before for the specific importance category) based on the following paragraph of the CANEPE.



Για πιθανότητα υπερβάσεως 10% εντός του συμβατικού χρόνου των 50 ετών λαμβάνεται υπόψη η σεισμική δράση του ΕΚ 8-1, ενώ για διαφορετική πιθανότητα υπερβάσεως εντός του συμβατικού χρόνου των 50 ετών λαμβάνεται υπόψη το ποσοστό της παραπάνω σεισμικής δράσεως του ΕΚ 8-1, σύμφωνα με τα διαλαμβανόμενα στην § 2.2. θεωρώντας αντίστοιχα σε όλες τις περιπτώσεις τον συντελεστή σπουδαιότητας γ₁ ίσο με τη μονάδα.

(3^η Αναθεώρηση 2022)

The script is now ready to run without even needing a spectrum update.

You then run the script, save the file of combinations and in the "**Checks**" option, the results of the checks for the method selection criteria are displayed.

In SS IN DI RANDING

IN S.S. Julie HAND. COLD

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The mass and stiffness difference test relates to criterion (v) of section (a) of § 5.5.2 of the CEQS.

The seismic wall shear test relates to criterion (vi) of section (a) of § 5.5.2 of the EIA.

The <u>relative movement controls between floors and nodes</u> relate to criteria (iii) and (iv) of section (a) of § 5.5.2 of the *EIS*. The first check concerns the relative movement between floors (above and below) and the node check concerns the movement of each node of the floor, relative to the average movement of the floor to which it belongs. Both of these checks are done per direction.

The control of idiosyncrasies relates to criterion (ii) of section (a) of § 5.5.2 of the CEQA.

The tests of inadequacy indicators and morphological regularity relate to criterion (i) of section (a) of § 5.5.2 of the CEQA. The check of the indicator λ is carried out per level separately for beams and columns and the number of beams above or below 2.5 and the percentage of the total number of beams or columns in the building is indicated, at each level respectively. The totals below are the sums per structural element and in total. Finally, the morphological regularity test includes the criterion of the average λ ki deficiency index of each floor (§ 5.5.1.2(c) CEQA).

OBSERVATIONS:

The preliminary analysis scenario is used to calculate the criteria for selecting the type of analysis and gives an idea of the regularity of the building and the resistance of the building to earthquake.

If, for example, there are λ >4 ratios for more than 30% of the building's elements, there is no point in further valuation of the building.

🚣 It is not used for the valuation and redesign of the building. Elastic or inelastic analysis is used for these procedures.

Based on the above criteria, therefore, inelastic (pushover) or elastic (static or dynamic) is applied.

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Φορτία Κόμβων	
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··· Εντατικά Μεγέθη Beam 3/D	
··· Εντατικό Μεγέθη Thin Plate	
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Συνδυασμοί Φορτίσεων	
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In the field of Prints, for the preliminary analysis scenario, in addition to the known modules, it contains the options :

• <u>Pre-testing results</u> (the controls of the criteria analysed above)

• Indicators of deficiency λ : where presented in detail for each element the result of the pre-check for beams and columns.

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2.3 Influence of the upper peculiarities

A further check is contained in paragraph 5.7.2(b) of the EIA and relates to the influence of higher eigenmodes.

The CAN states that for pushover to apply, <u>the influence of the higher eigenmodes must be insignificant</u>. The criterion for assessing how significant the influence is is as follows:

In order to check this condition, an <u>initial **dynamic elastic analysis**</u> is required where the seismic shear stress is calculated, for each floor and for each direction of the earthquake, once for those eigenmodes that activate at least 90% of the mass of the building and once for the fundamental (per direction) eigenmodes.

- The influence is considered significant when, even on one floor and in one direction, the ratio of the cutting force from the many eigenmodes (Vall) to the cutting force from one eigenmode (V1) is greater than 1.3.
- > This criterion was only incorporated in the scenarios of the EC8-Greek Dynamic Analysis.

The results are displayed in three places:

1. In the graph within the analysis by selecting "Upper Eigenmode Influence Check"

Report		×
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2. As tabulated results by selecting "Seismic Action"

1	Ελεγχος Επιρ	ροής Ανωτέ	(KAN.ΕΠΕ. παρ.5.7.2					
	Sum han é		Χ Διεύθυνση		Υ Διεύθυνση			
α/α Στάθμ.	Υψος (m)	Vall (Kn)	V1 (Kn)	Λόγος	Vall (Kn)	V1 (Kn)	Λόγος	
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2	3.00	675.33	593.93	1.14	954.65	811.29	1.18	
3	6.00	225.85	212.44	1.06	205.84	147.52	1.40	
ΣΗΜΕΙΩ	ΗΜΕΙΩΣΗ: Οι λόγοι δεν πρέπει να υπερβαίνουν την τιμή 1.3							

3. And finally in the print issue where an option has been added to the script to print the influence diagram of the upper eigenmodes.

So if this ratio is **greater than 1.3**, even at one level and in one direction, pushover <u>can still be performed</u>, but an <u>elastic</u> <u>dynamic analysis</u> (with seismic action calculated either from the EC8 design spectrum or from acceleration time histories) must be performed in parallel, using either method (m) or method (q).

- In this scenario, an increase of these rates by 25% is allowed.
- So of the two scenarios that will be run (pushover and dynamic) the worst-case outcomes should be taken.

This increase of the coefficients is done by the user through the new parameter in the method selection dialog box

Παράμετροι Ελαστ	ικής		\times
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🗹 Επούξηση (m),	(q) §5.7.2 (β)	25 %	6
- Τιμές του δείκτη α	υμπεριφοράς q'		
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ОК	ΦΑΣΜΑΤΑ	Cancel	

By checking the corresponding box. For method (q) the result is immediately shown in q appearing in the parameters

Παράμετροι ΕC8		×
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Ζωνη 1 γ γ 1 Φάσμα Φάσμα Απόκρισης Σχεδιασμ ζ(%) 5 Οριζ ζ(%) 5 Οριζ Φάσμα Απόκρισης Ενη Είδος Κατασκευής q Σκωρόδεμα αχ αχ αχ αχ αχ	ιού - Κλάση Πλασημότητος DCM - ζόνπο b0 2.5 Κατακόρυφο b0 3 μέρωση Φάσματος Sd(T) >= 0.2 a*g	Εκκεντρότητες Sd (T) ε πχ 0.05 *Lx sd (TY) ε πz 0.05 *Lz Sd (TZ)
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Μέθοδος Υπολογισμού Ιδιομορφική Ανάλυση Οριο Σχετικής Μετακίνησης ορό	 Δύσκαμπ Ζ Δύσκαμπ ζ Δύσκαμπ φου 0.005 Χαρακτηρισμός Σεισμοηλήκτων 	τα χωρικά πλαίσια από Σκυρόδεμα · · · · · · · · · · · · · · · · · · ·
Είδος Κατανομής Τριγωνι	κή ~	ΚΡΙΤΗΡΙΑ ΑΠΑΛΛΑΓΗΣ ΕΛΕΓΧΟΥ ΣΤΑΤΙΚΗΣ ΕΠΑΡΚΕΙΑΣ

while for (m) the augmentation is internal.

To summarize for the influence check of the upper eigenmodes the procedure is to check the influence criterion and when it is not met (ratio > 1.3) then in addition to the pushover an elastic dynamic should be performed by checking the 25% increment.

Based on the above criteria, therefore, inelastic (pushover) or elastic (static or dynamic) is applied.

3(a) STEP 3: ANALYTICAL ANALYSIS

3(a).1 General

The main objective of the static anelastic analysis is to estimate the magnitude of the inelastic deformations that will develop in the structural elements of the structure when it is subjected to the seismic action for which the assessment or redesign is performed. These magnitudes of inelastic deformations shall be compared with the allowable values determined on the basis of the target performance level and the capacities of the members.

In the static inelastic analysis, a simulation of the structure is used which takes into account inelastic loaddeformation laws for the individual structural elements of the building. For concrete in particular, due to the coexistence of flexural and shear deformations, the inelastic law of bending moment - chord angle of twist (M-i) is used.

The simulation is then subjected to horizontal loads distributed in a manner proportional to the inertial forces of the earthquake. The loads increase monotonically, generally until a structural element is no longer able to carry its vertical loads. During the loading process, each time a cross-section leaks (i.e. a **plastic joint** is formed) the simulation is modified by introducing appropriate connections and the incremental process continues.

At each step of the analysis, the **base shear** (i.e. the *sum of the horizontal loads*) and the displacement of a characteristic point of the tested structure (*control node*), which is generally taken at its top, are recorded.

Thus, <u>the base shear - peak displacement curve</u> called the **resistance curve** is drawn, which is considered representative of the general seismic behaviour of a structure and is the basis for all the required checks for the satisfaction of the performance criteria.

The primary resistance curve is idealised into a bilinear curve which is assumed to correspond to the forcedisplacement diagram of an equivalent single-stage system, the response of which is correlated with the response of the structure.

The design earthquake enters the process through its imposed movement of the control node, which is called **targeted movement**. The targeted displacement is calculated with the help of the elastic design spectrum of the excitation by applying the so-called displacement modification method. According to this, the target displacement is obtained from the elastic displacement of the equivalent single-stage system, which is multiplied by a number of correction factors to take into account certain factors such as the difference from the peak displacement of the beam, the difference in elastic/elastic displacement, the degradation of strengths and stiffnesses due to cyclic loading and the influence of P-D effects.

The last step of the Elastic Static Analysis is the check of the performance criteria, i.e. the comparison of the available strength values of the cross-sections of the structure with the required response values corresponding to a displacement of the control node equal to the target one.

For fishy failure modes and behaviour the check shall be in terms of transient quantities, while for plagiform failure modes and behaviour the check shall be in terms of displacements or

deformations. In the latter case, the acceptance criteria are expressed as percentages of exhaustion of the available plastic displacement or deformation, depending on the desired level of performance of the structure.

After calculating the M-N interaction diagrams the model is now ready for the pushover analysis. First, returning to the Section: "**Analysis**", you create an inelastic analysis scenario.



 For Greece, you select EC-8 Greek/Anelastica and for Cyprus, Italy and Austria, for which the Eurocode appendices have been integrated.

(For all other European countries, select EC-8 General and manually enter the parameters of the respective attachments)

- Especially for static inelastic analysis scenario, whether it is Eurocode 8 or CEE (EC-8_Greek / Inelastic), the multipliers of inertial quantities to be defined here will be taken into account in the first Pushover analysis concerning the permanent and
 - mobile loads with default values those provided by EC8.
- Then, in the parameters of the inelastic analysis, you can specify whether these values will be kept the same as in the first step in all

the steps of the process or whether they will be reduced at each step, starting of course from the whole initial values. Impairment may be applied either at the beginning of each step or after the plastic joint has been created.

3(a).2 Creating an Elastic Analysis Scenario

Within the list of scenarios, in addition to the two default scenarios, the inelastic scenario has now been created.

Scenario	×
Επαναρίθμηση Κόμβων Οχι	✓ ☐ Advanced Multi-Threaded Solver
🗌 Ακύρωση	Ονομα
EC-8_Greek Static (0) EC-8 Greek Dynamic (1)	Avàλυση EC-8_Greek ~
EC-8_Greek Προέλεγχος Static	Τύπος Ανελαστική 🗸
EC-8_Greek Ανελαστική (4)	– Ιδιότητες Static Dynamic
	Μέλη Ανελαστική Ελαστική Static
	Φορτίο Ελαστική Dynamic Προέλεγχος Static
	Προέλεγχος Dynamic Time History Linear Time History Non Linear
	Εξοδος

3(a).3 Scenario execution

3(a).3.1 Updating Data

- T	Εκτέλεσ	ης Pushover /	Ανάλυα	σης		×
2	Παράμετροι	Κέντρα Μάζας ((cm)			~ ~
3	Αυτόματη Διαδικασία	Level	Х	Y	Z	^
Διαδικ	ασία	0 - 0.00	0.00	0.00	0.00	
	Μάζες-Ακαμψίες	1 - 400.00	0.00	400.00	0.00	
	Στατική-Δυναμική	2 - 700.00	0.00	700.00	0.00	
	Pushover	3 - 1000.00	0.00	1000.00	0.00	
						_
					_	_
						v
1 [Ενημέρωση Δεδομένων		Eξ	οδος		

3(a).3.2 Parameters

ζεισμική ι ιεριοχή	Χαρακτηριστικές Περίοδοι		Επίπεδα ΧΖ
Σεισμικές Περιοχές	Τύπος Φάσματος Ορ	οιζόντιο Κατακόρ.	Κάτω 0-0.00 🗸 Ανω 2-600,00
a 0.36 *o	Tùnoç 1 🗸 S,avg	1.2 0.9	Ελεγχος πλαστικοποίησης κάτω απο την στάθμη
a (KAN.EDE.) 0.216 *g	Εδαφος ΤΒ(S)	0.15 0.05	
Σπουδαιότητα	B V TC(S)	0.5 0.15	
Zŵvŋ I v Yi 1	TD(S)	2.5 1	
Φάσμα			
Φάσμα Απόκρισης Ελαστικ	ό 🗸 Κλάση Πλαστιμότητα	ος DCM 🗸	
ζ(%) 5 Ορ	ιζόντιο 60 2.5 Κατακό	ουφο b0 3	Sd (TX)
Φάσμα Απόκοιστος Εν	ουέουσο Φάσυστος		е т х 🗌 0.05 *1 х 🔤 1
+oopermorphones	Incharol acceleration 20(1	() >= 0.2 ag	Sa (17) +
εεισμικοι συνουασμοι			
	γωνική Κατανομή		
	θογωνική Κατανομή	<u></u>	
-Fx-kFz Tu	χηματικές εκκεντρότητες Εχ	E-Ex	Αριθμος Βηματων 200 Ευρος Λάμδα (%)
	χηματικές εκκεντροτητές ΕΖ	±z	Μέγιστη μετακίνηση 3 % του ύψους του κπρί
-Fz+kFx	λογη Τεμνουσας Βασης Απο Φαα	πμα Σχεοιασμού.	Υπολογισμός σταθερής τιμής μήκους διάτμησης L
LI-FZ-KFX 20VIE	אנט דוק ביז געסטטט שטס זוטדק (ג)	0.5	Ενεργός δυσκαμψία Υπολογισμός σε κάθε βήμα
Dofault Характа	ρισμός ΟΚ Com	-ol dasmata	ΣΤΑΘΜΕΣ ΑΞΙΟΠΙΣΤΙΑΣ ΔΕΔΟΜΕΝΩΝ
	ήκτων	WAZMATA	🔲 Ελεγχος Επρροών 2ας Τάξης (θ)
Σεισμοπλ			
Σεισμοπλ Υπολογισμός Στοχευόμενης	κατά KAN.EΠE. 🗸		Μ.Ι.Π. Τοιχοποιία Λοιπά μέλη
Σεισμοπλ Υπολογισμός Στοχευόμενης Καμπύλες ικανότητας	κατά ΚΑΝ.ΕΠΕ. 🗸	Πλαστικές αρθρώ	Μ.Ι.Π. Τοιχοποιία Λοιπά μέλη σεις και 🔽 🗌
Σεισμοπλ Υπολογισμός Στοχευόμενης ι Καμπύλες ικανότητας Με βαθμιαία απώ	κατά ΚΑΝ.ΕΠΕ. 🗸	Πλαστικές αρθρώ στα δύο άκρα Εναπομένουσα αν	Μ.Ι.Π. Τοιχοποιία Λοιπά μέλη σεις και 🔽 🗌 ντοχή 🗹 🗹
Σεισμοπλ Υπολογισμός Στοχευόμενης Καμπύλες ικανότητας Με βαθμιαία απώ Μένιστος αριθμός γου το	κατά ΚΑΝ.ΕΠΕ. ~	Πλαστικές αρθρώ στα δύο άκρα Εναπομένουσα αν Vres :	M.I.Π. Τοιχοποιία Λοιπά μέλη σεις και ντοχή = 0,5 * VRd 0.25 * VRd

In the above dialogue box of the parameters of the inelastic analysis, the definition of the parameters in the two boxes enclosed by the two rectangles is the same as in the corresponding Eurocode scenario.

OBSERVATION:

- It is important that according to CAN.EPE the response range should be Elastic.
- In the "XZ Levels" section

Eninεδ	a XZ							
Κάτω	0 - 0.00	~	Ανω	3 - 1000.00	~			
Ελεγχος πλαστικοποίησης κάτω απο την στάθμη αναφοράς								

You define from which level to which level the horizontal seismic load will be applied It is suggested that the upper level be defined as the last full level (not staircase ends). This level will include the control node, which will be either the bulkhead node or another node on the outer perimeter of the building.

The option "Check for plasticization below the reference level" when checked takes into account as possible locations of plastic joints also elements below the reference level.

In the section "Seismic Combinations"

- Σεισμικοί συνδυασμοί	
🖌 Fx +k Fz	🗹 Τριγωνική Κατανομή
Fx - k Fz	✔ Ορθογωνική Κατανομή
✓ -Fx + k Fz	
-Fx - k Fz	Τυχηματικές εκεντρότητες Εχ
🖌 Fz + k Fx	Τυχηματικές εκεντρότητες Εz
Fz-kFx ✓-Fz+kFx	🗌 Επιλογή Τέμνουσας Βάσης Από Φάσμα Σχεδιασμού.
-Fz - k Fx	Συντελεστής Εγκάρσιας Φόρτισης (k) 0.3

- You define the combinations for which inelastic analyses will be performed. Each combination means that a seismic force will be applied in the specific direction (x or z) with a factor of 1 and a seismic force in the transverse direction with a factor which you specify in the '<u>Transverse loading factor</u>' field.
 - The default value is 0.3.
- You also specify the type of distribution of the seismic force along the height of the building (triangular or rectangular).
 - 1. The EIA requires both seismic distributions.

EPE 5.7.3.3.3 Distribution of seismic loads by height

The horizontal static loads will be applied at the level of each diaphragm (floor slab), according to the distribution of the inertial loads of the earthquake. All analyses shall require the application of at least two different load distributions per height, in order to take into account (as far as possible) the variation of load distribution due to the meteorological behaviour of certain areas of the structure, but also due to the influence of the upper eigenmodes.

- Also, if you want to take into account, in addition to the seismic forces, moments resulting from the accidental eccentricities, activate the fields "<u>Accidental eccentricities Eh and Ez</u>".
- "Select Base Cutting Force from Design Spectrum" when checked, uses as base cutting force the one calculated by the dynamic analysis.
 - Selecting all combinations with the random eccentricities produces a total of 64 combinations which means 64 inelastic analyses resulting in an increase in vector resolution time.
- Here are the parameters listed in the following section

Κόμβος Ελέγχου	26	🗹 Ενεργές Τοιχοπληρώσε					
Αριθμός Βημάτων	200	Ευρος λάμδα (%)	0				
Μέγιστη μετακίνηση	3	% του ύψους του κτι	ipiou				
🗹 Υπολογισμός στα	θερής τ	ιμής μήκους διάτμησης	;LS				
Ενεργός δυσκαμψία Υπολογισμός σε κάθε βήμα 🚿							
ΣΤΑΘΜΕΣ ΑΞΙΟΠΙΣΤΙΑΣ ΔΕΔΟΜΕΝΩΝ							
Ελεγχος Επιρροών 2ας Τάξης (θ)							

In the option "<u>Active Wall Fillings</u>" we select whether we want to take into account in the analysis the wall fillings that we have included in our construction .

🖌 Ενεργές Τοιχοπληρώσεις

In the option "<u>2nd Order (i) Influence Check</u> Ελεγχος Επιρροών 2ας Τάξης (θ) we choose to perform the relevant check.

"<u>Control node</u>" you specify the number of the control node on the basis of which the targeted movement will be calculated.

CAN.EPE 5.7.3.2 Definition of the control node

The control node of the targeted movement will generally be taken at the centre of mass of the roof of the building. For buildings with attics or small dwellings in the attic, the control node shall be taken at the roof of the full underlying floor. The movement of the control node shall be calculated from the simulation analysis for horizontal static loads. This node is usually the bulkhead node of the last full floor of the building. If there is no bulkhead, choose a perimeter node from the same level. In this example, the Control Node is 63.

"<u>Number of Steps</u>" sets the maximum number of steps (analyses) that each inelastic analysis will perform Pushover is an iterative process that is terminated, when no other limit is set, once the vector is converted to a mechanism. The number of steps is an upper maximum limit in order to avoid too many steps before the vector becomes a mechanism.

The default value is 200.

The <u>"Maximum movement"</u> option as a percentage (%) of the total height of the building is second way to set an upper limit on the number of steps before the carrier becomes a mechanism. The process stops as soon as the maximum movement of the control node exceeds the specified percentage of the building height.

The default value is 3% of the total height of the building.

The next parameter <u>"Lambda range (%)"</u> refers to the load factor λ . At each step the load factor λ is calculated for each element and the minimum value from all the structural elements determines that element at which the plastic joint will be created. With the default value of 0 in this parameter, the program selects a minimum value, i.e. only one element, even if there are values from other elements that are very close to this value.

Setting a value different from 0 e.g. 10% means that those λ values that are less than or equal to the minimum value λ plus 10% will be taken into account in this step, resulting in a single step to create more than one plastic joint at a time and thus reducing the number of steps in the analysis.

EXAMPLE:

Suppose that in the first step of the pushover or minimum value λ is 1 and corresponds to a specific structural element on which the plastic joint will be created. By setting a value of 10% in this parameter, elements with λ values from 1 to 1.1 will also have plastic joints created in them, simultaneously with the first element.

In the "Calculate constant LS shear length value" option you specify:

 whether the shear length of the elements will be calculated with a fixed value based on their length in all steps as provided for in the CEQA (ticked)

EPE *The calculation of stiffness according to Eq. (2) through My, *θ*y can be based on a fixed value of Ls, as follows:

- In beams connected at both ends by vertical members, Ls may be taken to be equal to half the net span of the beam.

- In beams connected to a vertical member at one end only, Ls may be taken to be equal to the total net span of the beam.

- In columns, Ls may be taken as half of the net height between beams to which the column is monolithically connected within the considered plane of bending.

- In walls, Ls can be taken on each floor differently and equal to half the distance of the floor base cross-section from the top of the wall in the building.

• or whether it shall be calculated at each step of the inelastic analysis on the basis of the resulting intensities, where

Shear length = M/V at the end section of the element, i.e. the distance of the end section from the zero point of the moments.

The parameter "Active stiffness" concerns the way of calculating the stiffnesses of the elements of the structure.

CAN.EPE *7.2.3. Active stiffness of OS data

The active stiffness of the element length Ls equal to: **K=MyLs/3θy (2)**

where My and ϑy are the value of the moment and chord angle of twist, respectively, at the yielding of the end section of the element.

The active stiffness K of the total length of the element can be taken to be equal to average of the values calculated from Eq. (2) at the two end cross-sections of the element. If these cross-sections have a non-symmetrical shape or reinforcement (i.e. different for positive or negative bending moment), the average of the values of K from Eq. (2) for the two times of bending (positive or negative).

The first step of the inelastic analysis is to calculate intensive quantities from the permanent and mobile loads of the structure. The stiffnesses taken into account for these quantities are multiplied by the coefficients specified in the scenario parameters in the "Members" option. In the second step of the inelastic analysis where the seismic load is applied the program now gives three possibilities for this calculation.

- <u>Home</u>: The rigidities of the elements will be maintained with coefficients of units in all the steps of the process.
- <u>Calculation at each step</u>: The CAN.EPE provides at each step of the pushover a reduction of stiffness. This option recalculates at each step, regardless of whether or not a plastic joint has been created, the stiffnesses based on the stiffnesses specified in the EPC. The value of the stiffnesses to which the impairment is applied is the original value, not the impaired value applied only in the first step.
- <u>After the plastic joint</u>: This option is the same as the previous one with the difference that the impairment takes place after the plastic joint is created. Until the step this element retains the rigidity of the first step.
- Finally, in the <u>"Data Reliability Level"</u> option, you select the corresponding SDSs.

Στάθμες Αξιοπιστί	ας Δεδομένων	×	
Στάθμη Αξιοπιστί	ος Δεδομένων		for the existing building CEE. This choice affects
Γεωμετρίας	Ικανοποιητική	~	γg on the basis of which
Υλικού	Ικανοποιητική	~	
Λεπτομερειών	Ικανοποιητική	~	
0	Cancel		ence Check (i)"
Ελεγχος Επιρ	ροών 2ας Τάξης (θ) we	choose to pe	erform the relevant check.

or the existing building according to the provisions of the CEE. This choice affects the coefficient of permanent loads *y***g** on the basis of which the building will be solved.

.

In this example, the default values of the parameters were selected.

The "PHASMS" button refers to the Targeted Behavior in relation to the Damage Level. Selecting it displays the following

dialog box:

We select the seismic hazard category with the corresponding seismic triad and the factor by which the initial reference ground acceleration is to be multiplied to obtain the ground acceleration of the CER

λάσματα				\times
Στόχοι αποτίμησης ή ανασχεδιασμού Φέροντος Οργανισμού	A1 B1	Г1	1.00	\sim
Ζωή σχεδιασμού (έτη) 50 🗸	A0 B0 A1+B1+	Γ0 • Γ1+	1.80	
Περιορισμένες Βλάβες (Α - DL)	A1 B1 A2+B2+ A2 B2	· F2+	1.00 0.75 0.60	
Ελεγχος Εδαφική επιτάχυνση ag=AgR.γΙ.(ΤΕ Υπολογισμός TR	A3+B3+ A3 B3	· Г3+ Г3	0.45	
Περίοδος επαναφοράς TR (έτη) 475 Πιθανότητα υπέρ	A4+B4+ A4 B4	• Г4+ Г4	0.25 <0.25	

or the default 10% or 30% which automatically sets the Target:

Φόσμστα	×	Φάσματα
Στάχοι αποτήμησης ή ανοσιχοδιοσμού Φέροντος Οργαινομού	1.00 · · ·	Στόχοι ατοτίμησης ή ανασχοδιασμού θέροντος Οργανισμού 🗛 82 F2 0.60
2ωή αχοδοσμήζε(έτη) 50 γ Βεθέτης k (3.0)	3	2ωή σχαδοσχού (km) 50 × ¹ / ₂ 5x86m; k (3.0) 3
Eloped Every Report (A - UL) Eloped Entropy annound agrild A.V. (R./TLR) (A Yankarando TR Yankarando TR	0.24	(Epopolycics Brates, IA - UL) [2] EARYARC ESosper) Entributing agridge-X(L(TR/TLR)1A [0.144 Transformation TR Transformation TR
Περίοδος επαγαφοράς ΤΕΙ (έτη) 475 Πθονότητα υπέρβασης PLR %	10	Περίοδος επαναφοράς Τ.Κ. (έτη) 135 Πιθονάτητα υπέρβασης ΡUR % 10
Πιθανότητα υπέρβασης PR.% 10 Περίοδος επαναφορός TLR (έτη)	475	Πιθανάτητα υπάρβασης PR16 30 Παρίοδος επανοφορός TLR (έτη) 475
Σημαντικός Βλάβες (Β - 50)		Σημαντικές Βλάβες (Β - 50)
Εδαφική επήχονση ag=AgA.vt.(TR/TLR)1/k Υπολογισμός TR Υπολογισμός TLR	0.24	Εξέφχαση εποιοχώνση αριαλάζει τη τρογογιατία το
Περίοδος επαναφορός ΤR. (έτη) 475 Πιθονότητα υπέρβασης PLR%	10	Περίοδος επαναφορός ΤΚ (έπ) 135 Πιθανότητα υπέρβασης ΡLR% 10
Πθανάτητα υπέρβασης PR% 00 Περίοδος εποναφοράς TLR. (έτη)	475	Πθανότητα υπέρβασης PR% 30 Παρίοδος εποναφορός TLR (έτη) 475
Olevel Karóppeuery (F - NC)		Olevel Kandopeuan (/ - NC)
Εδοφική επτόχυνση agr#AgR.γL(TR/TLR)1/k Υπολογισμός TR Υπολογισμός TLR	0.24	ΞΕλεγχος Εδαφική επτόχυνση εφι«ΑφΑ.γΕ.(TR/TLR) I/k 0.144 Υπολογιαμός TLR Υπολογιαμός TLR
Περίοδος επαναφορός Τ.R. (έπι) 475 Πιθονότητα υπίρβασης PLR %	10	Περίοδος επαναφορός ΤΕ (έτη) 1.25 Πιθανότητα υπίρβοσης PLR % 10
Πθανότητα υπέρβασης PR % 20 Περίοδος επαναφοράς ΤLR (έτη)	475	Πθανότητα υπέρβασης PR% 30 Περίοδος επαναφορίες ΤLR (έτη) 475
Toochiloyn KANETE 10% KANETE 10% KANETE 10%	E8 20%	Tipoenkoyn KANETE 10% KANETE 30% ES 2% ES 2% ES 2%
OK Cancel		OK Cancel

and returning to the initial parameters of the scenario in the field of ground acceleration CAN.EPE. אלבוסעווגה הבאסאלי

Σε	Σεισμικές Περιοχές								
Ζώνη Ι	I	\sim	а	0.24	* 9				
a (KA	N.E	0.144	*g						

we see the value of the ground acceleration as it was calculated previously and as it will be used in the execution of the scenario for the calculation of the seismic action.

It is also noted that the yi used for the calculation of the seismic action always becomes 1 (from 0.8 which was before for the specific importance category) based on the following paragraph of the CANEPE.



Για πιθανότητα υπερβάσεως 10% εντός του συμβατικού χρόνου των 50 ετών λαμβάνεται υπόψη η σεισμική δράση του ΕΚ 8-1, ενώ για διαφορετική πιθανότητα υπερβάσεως εντός του συμβατικού χρόνου των 50 ετών λαμβάνεται υπόψη το ποσοστό της παραπάνω σεισμικής δράσεως του ΕΚ 8-1, σύμφωνα με τα διαλαμβανόμενα στην § 2.2. θεωρώντας αντίστοιχα σε όλες τις περιπτώσεις τον συντελεστή σπουδαιότητας γι ίσο με τη μονάδα.

The script is now ready to run without even needing a spectrum update.

G. Earthquake victims - Official Gazette, No. No. 455, 25/02/20



not for the preparation of rehabilitation studies for reinforced concrete buildings damaged by earthquake and the issuance of the relevant repair permits.

According to the F.E.K., depending on the loss of load-bearing capacity (Af) and the time studied, buildings are classified as follows:

ΚΤΙΡΙΑ ΜΕ ΒΛΑΒΕΣ ΠΕΡΙΟΡΙΣΜΕΝΗΣ ΣΠΟΥΔΑΙΟΤΗΤΑΣ (ΤΟΠΙΚΟΥ ΧΑΡΑΚΤΗΡΑ)					
ΚΤΙΡΙΑ ΜΕ ΒΛΑΒΕΣ ΠΟΥ ΕΠΗΡΕΑΖΟΥΝ ΕΝ ΓΕΝΕΙ ΤΗΝ ΑΣΦΑΛΕΙΑ ΤΟΥ ΚΤΙΡΙΟΥ (ΓΕΝΙΚΟΥ ΧΑΡΑΚΤΗΡΑ)	Αφ > 0,12				

- Af≤0,12 No valuation study required
- Af>0,12 Valuation study required

Select the command and in the window "Characterization according to the influence of faults" define the fault in the members and/or nodes.

Enter the date of issue of the construction permit.

Members are displayed by level with their physical and mathematical number and aside, in case of failure, select one of the descriptions as detailed in

???

the corresponding F.E.K., which opens as a pdf file, by pressing the



After you have finished the description, press the button results by level, at the bottom of the window

Υπολογισμός to see the summary

Level 1 ΣRi=5.500 Σn=6 Aφ=0.08333 <= 0.12 Ικαν	опоієітаі
Level 2 ΣRi=5.800 Σn=6 Aφ=0.03333 <= 0.12 Ικαν	опоієітаі
Level 3 ΣRi=6.000 Σn=6 Aφ=0.00000 <= 0.12 Ικαν	οποιείται
Level 4 ΣRi=4.000 Σn=4 Aφ=0.00000 <= 0.12 Iκαν	οποιείται
Level 5 ΣRi=4.000 Σn=4 Aφ=0.00000 <= 0.12 Iκαν	οποιείται
Level 6 ΣRi=4.000 Σn=4 Aφ=0.00000 <= 0.12 Ικαν	οποιείται

Selecting the command

opens the .txt file with detailed results of the tests per floor.

check_seism.txt - WordPad									×						
File	Edit Vie	w Insert	Forma	t Help											
D	🛎 🖬 🤞	5 🔍	M X	Pa 💼	n 💀										
	Ετ	ος Κατα	σκευής	: 198	5	-									^
	Οροφος	ΣRi		n	1	Αφ		Κρι	τήριο						
	1	5	.500	6	i i	0.08	33	<	0.12	1	Ικανοποιείται				
	2	5	.800	6	1	0.03	33	<	0.12	1	Ικανοποιείται				
	3	6	.000	6	1	0.00	00	<	0.12	1	Ικανοποιείται				
	4	4	.000	4	1	0.00	00	<	0.12	- I	Ικανοποιείται				
	5	4	.000	4	1	0.00	00	<	0.12	- I	Ικανοποιείται				
	6	4	.000	4	1	0.00	00	<	0.12	1	Ικανοποιείται				
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Ορ	οφος :	1													
A/	ΆΙ Περ	ιγραφή	Βλάβης	στοιχ	είου	Ματ	Ri	1	Περιγρ	οαφή	βλάβης κόμβου		R	i	
	1 B1 / B)	Πολλαπ) é a . xo		c. oww	1021	10 80	181.0		207				00	
	TIDT(b)	noznan uéc uc	πες κα ταξύ 2	mm.	ς ρωγ- <=5mm	.1071	10.80	I DT (γ) ΠΟ2 1162		τος καμπτικος γ	ρωγ-	1	00	
	+	μες με	ιαςυ 2 		<-5mm	+	 +	 +	μες	;>5111	u 		-+		
	1					joxi	1.00	i -					j1.	00	
	-+					+	+	+					-+		
	2 Α Απλ	ές καμπ	τικές	ρωγμές	<=2mm	IOXI	0.90	L					1.	00	
	-+					+	+	+					-+		
I	2 -+					10X1	+	 +					11.		
	3 B1 (α)	Πολλαπ	λές κο	αμπτικέ	c	ioxi	10.90	i -					i1.	00	
	1	ρωγμές	<=2mm		•	1		i –					1		
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	3 B1 (α)	Πολλαπ	λές κο	φπτικέ	S	IXOI	0.90	1					1.	00	
	1	ρωγμές	<=2mm			1	l i	1					1		
	-+					+	+	+					-+		
00	οφος :	2													۷
For H	lelp, press F	1											N	UM	11.

OBSERVATION:

In cases where there is a requirement for the preparation of rehabilitation studies for earthquake-affected buildings (*Af*>0.12), then the corresponding Acceleration Range for the Design of Repairs should be determined, in accordance with the relevant F.E.K.

H. Spectrum acceleration for on design repair design earthquake victims -Fire-ravaged buildings

You have the option to apply GGC455/25-2-14 and GGC2775/18-12-15 and automatically calculate the acceleration range for the design of earthquake and fire damaged building repairs.

The 2 GGCs are identical and the difference between them concerns the <u>definition of</u> the Characterisation of buildings depending on the influence of the damage.

 For the Earthquake Affected Buildings Government Gazette 455/25-2-14 the determination of the Characterization is made according to the

loss of load-bearing capacity (Af) and the time studied, the buildings are classified as follows:

ΚΤΙΡΙΑ ΜΕ ΒΛΑΒΕΣ ΠΕΡΙΟΡΙΣΜΕΝΗΣ ΣΠΟΥΔΑΙΟΤΗΤΑΣ (ΤΟΠΙΚΟΥ ΧΑΡΑΚΤΗΡΑ)					
ΚΤΙΡΙΑ ΜΕ ΒΛΑΒΕΣ ΠΟΥ ΕΠΗΡΕΑΖΟΥΝ ΕΝ ΓΕΝΕΙ ΤΗΝ ΑΣΦΑΛΕΙΑ ΤΟΥ ΚΤΙΡΙΟΥ (ΓΕΝΙΚΟΥ ΧΑΡΑΚΤΗΡΑ)	Αφ > 0,12				

While for the fire-affected buildings, the classification of the damage (i.e.

affect or not the general stability of the building) is determined on the basis of the above-mentioned description and number of damages estimated and proposed by the designer.

Depending on the choice of the analysis scenario, either *linear* or *non-linear* analysis, you can define the acceleration range for earthquake and fire affected buildings through the corresponding parameters.

Ελεγχος Σεις	anon'	Аġкт	uv - Nupen	λήκτω	v				
κατηγορία κτιρίων	1	¥	Περίοδο	Περίοδος κοτοσκευής nplv το 1985					777
Συντελεστής σεισι	μικής	επιβ	Ιαρύνσεως	0	u*/g	0		γπολογισμός Φ	οάσματος

Select the analysis scenario and open the parameters



For the earthquake victims:

Χαρακτηρισμός

Preceded by EcouponAfictrov where Table 1 (Fault description and Reduction Factors R Reduction Factors R Element Capacity)

EK AFIGNA A BAABHE GAINE BYLLE 11		ĸ														
		YNOLTY ADMATA		TOOLOMATA		KOMBOI										
	gaine agiue 11	BAADHE	KTIPUA META TO 1985	KTIPIA (IPIN ATO 1985	KTUMA META TO 1985	KTIMA INPIN AND 1885	КПРИА МЕТА ТО 1995	ATIPLA. IDRN ADD TMS	12	kaljej poryskij > žem	0,35	128	8,15	1.05		
	անել ապանվ թացվել < 2000	1,00 (0,76°)	0,00 (0,00")	6,16 (6,72°)	1,85 (5,60°)				orridaer skand, so- prostig peoplet, Au-	- 600					1	
B1 (a)	notivestal programming program	1,00 (0,10*)	0,96 (0,68°)	5,50 (0,72°)	6.15 (196.6)		ADV	^	sequels; palgithere conte- equels; person length;	0,18	1		2	0		
01 (P)	esilantiquamid; perio; and; 2mm<_5 bren	0.90 (0,70°)	0.60 (0.60°)	6,76	2.43	OPIZETAI		Et	αριζονται υποθηση στη βάσηθέση πάκτωσης παρόματας με μωγμή 5 4000 και μεταλοτητη			0.50	9.50			
81 (Y)	modulating segments; pospulg > Smith	8,80 (0,70°)	9,79 (5,60°)	6,62	0.55			1.110	άφμα 5 τοπη φοζόναι σκοιθμη στη βάσχθαη πάστωση τοφόμπης με μωγμή >4444 και μεταθείχη άφμα > τοπη			62	2222	OPRETAI		
82 (a)	λαβξ (καμβς ≤ 1000	0,90 (0.70')	0,60 (55.0)	6.70	0.02			E2				5,45	4.36			
82 (ß)	ANGE progat particle town <	8,86 (0,70')	10,110 (6,64°)	36,48	1,45	2.10	1.21	1 Or mality antigeration have public	¹ Or right sinds, magnificanty, exception force in BMASs, generatives in impactly, antibusing in integrations, the served-convert sorts or managementation of BMAss, see and projections sent prior and pABAs are already association (Bos, uniteriment registering readioapp), second projection).							
82 (Y)	kotja; polygalic ganažić žena C., S.Senar	0.60	0.65	5.4E	6.30			T. H Avyd Z. D ₅ DA 3. Tolgae	 Η συχθυ βλάξει σύχδου χειροσοιμήζει το ειστοι δυγία πλογβαί που πονηληρικό τα πολ. Dig βλάξει στους κλάβους ποσόπτα μόνα ο κτής το σταξατία του σύχδια. Trobyski που πρώτο καταθουρία στατιχάτε με λάγα πλοιμών διατομές χρητιδιασί του τρότο. Το πόμου πλαθαίριστο διασό στατιχάτε με λάγα πλοιμών διατομές χρητιδιασί του τρότο. Το πόμου πλαθαίριστο διασό στατιχάτε με λάγα πλοιμών διατομές χρητιδιασί του τρότο. Το πόμου πλαθαίριστο διασό στατιχάτε με λάγα πλοιμών διατομές χρητιδιασί του τρότο του πλοιου 1. Το πόμου πλαθαίριστο διασό στατικούη γίναται γραγματή του τρότο του τρότο του Τλοιου 1. Το πόμου ποι τρότο του πλοιου 1 ψεται αποκλειστικό και μόνα τορο τροφορί της οχύσης: ⁶/₂ D 							
ľ1 (s)	nay medi penyah), Aryang palphar untanjak, penahay- un manar 5.2%	0,00	0,40	6,36	4,55	6.28	8.15	из (19 4 (1991) 5 Нур								
F1 (\$)	$\label{eq:action} \begin{split} & \operatorname{Ao(A)}_{\mathrm{Bol}} \operatorname{Bol}($	0.45	6,50	0,20	4.18			Ap-1	$A_0 = \frac{1}{2} \frac{2\pi^2}{m_{ee}}$, noo opport ve inviseljusti ng olestatig emukaci, eripologi, kontining me vipele Rolpin $2 = m_{ee} \frac{1}{2}$							

11	DC SUIT	postrul	C 1970 min Milkoc 216	Mad (om)		111
Ĺ.,	Na	Ele_	Περιγραφή βλάβης	Βλάβη στον Κόμ	Μά.,	Rí
1	1	1	Β1(β) Πολλαπλές καμπτικ 🔳	Β1(β) Πολλαπ 🗶	-	0.60
i.	2	2	Δ Απώλεια υλικού,καμπτι 💌	Δ Απώλεια υλ 💌		0.00
Ē.	3	3	82(γ) Λοξές ρωγμές μετα 🔳	Γ1(β) Λοξές δι	-	0.30
E)	4	4	Β1(γ) Πολλαπλές καμπτικ 💌	ΒΖ(α) Λοξές ρ		0.70
Ē.	5	5	B1(y) Πολλαπλές καμπτικ 🗵	82(α) Λοξές p		0.70
Ľ	б	б	Β1(γ) Πολλαπλές καμπτικ 💌	Β2(α) Λοξές ρ. 💌		0.70
C)	7	7	Β1(γ) Πολλαπλές καμπτικ 💌	ΒΖ(α) Λοξές ρ. 🗶	1	0.70
E.	8	8	Β1(γ) Πολλαπλές καμπτικ 💌	Β2(α) Λοξές ρ. 💌	-	0.70
	9	9	Β1(γ) Πολλαπλές καμπτικ 💌	Β2(α) Λοξές ρ	Г	0.50
I.	10	10	Β1(γ) Πολλαπλές καμπτικ 💌	B2(α) Λοξές ρ. 💌	-	0.70
	11	11	Β1(γ) Πολλαπλές καμπτικ 💌	Β2(α) Λοξές ρ. 💌	Г	0.70
0						2
eve	1 1 2Ri	-5.300	Ση=14 Αφ=0.62143 > 0.12 Δεν Ικαν	ondesit.	1	Υπολογισμός
EVE	3 2Ri		Αποτιελέσματα			
PW	1 5 2Ri		Μηδιολισμός			
			OK			

Πίσακας 1. Παριγραφή βλαβών και Συντελαττώς Μαίωσης Η Φέρουστος Ικενότητος Στουρίων.

from which the requirement to prepare rehabilitation studies has been derived (i.e. where Af>0,12) and

• for the **fire victims**

with damage affecting the general safety of the building (of a general nature)

select Φάσμα Απόκρισης to set the range.

The bottom part of the window that opens is about the earthquake-affected fire victims:

🗹 Ελεγχος Σεισμοπλήκτων - Πυροπλήκτων											
I	Κατηγορία κτιρίων	I ~	Περίοδο	EAK	???						
	Συντελεστής σεισμ	μκής επι	βαρύνσεως	0	a*/g	0	Υπολογισμός Φά	ισματος			

in case the designer wants to take into account in the pushover a spectrum other than that of EC8-1. Paragraph 5.7.4.2 of the EIA Code states that the spectrum used is that of EC8. The program by default uses this spectrum.

If the designer wants to take into account the spectrum of earthquake-fire victims, he/she checks the option "**Check Earthquake-Fire Victims**" and the program takes into account this spectrum or any other spectrum entered "manually" in the table of values. Also, when the earthquake-firefatality spectrum is selected, it prints only the one targeted for performance level B.

The Objective for the Assessment and Design of the load-bearing structure of reinforced concrete buildings is a combination of:

- of a Performance Level: the level is defined for all cases
 "Significant Damage" (B),
- of a Seismic Action (design earthquake): according to the CATEGORY (KI, KII) of the building.

To check the earthquake-fire victims, first activate the corresponding checkbox

Ελεγχος Σεισμοπλήκτων - Πυροπλήκτων

Then you define the "Category of buildings" according to the Government Gazette 455/25-2-14 or Government Gazette 2775/18-12-15 where two categories of existing earthquake-affected-fire-affected buildings made of reinforced concrete (I,II) are distinguished, depending on the method of seismic calculation with which they were designed.

i. For buildings of category KI:



set the "**Seismic Load Factor e**" used for the design of the building, for the calculation of the *Horizontal Design* Acceleration a^*/g according to Table 3 or 2 respectively (they are the same with differential numbering) and select

the command Υπολογισμός Φάσματος
Tiras	ος 3 Τωές Ορζόντος Οτπάχωσης Ζχεδα Κυρίων	юций атурка Коттуруюция	sensabet de Rit	ty attelige	אווי) דווג (גע	portpos al	Πίνακος	 Τωές Οριζόνπος Εππάχυνσης Σχεδ βαρύητος gł Χηρίων Κατηγορίος Α 	каарой a' [; q.	g (avryyd	wij atriv er	nqkovali	nç
	Zŵng Ecouards Env	evêwêm)a	c i jEAK2	003)				Ζώνη Σουμικής Επι	υνδινότητα	; 1 (EAK2	003)		
Euro (Ave	ελεστής Σεισμικής Επιβαρονοτιμη (αποιρικός Κονονισμός 1959/84-85)	0.04	0.06	0.08	0.12	0.16	Euvr (Ars	ελεστής Σεισμικής Επιβαριίνσεως ε σεσομικός Κανονισμός 1969/84-86)	0.04	0.06	0.08	0.12	Γ
+7.	Σπουδαιστητα Κτιρίου. ΣΙ Β. ΣΗ	0.00	0.11	0.14	0.21	0.29		Σπουδαίσητα Κηρίου: ΣΙ & ΣΙ	0.09	0.11	0.14	0.21	t
#18:	Σπουδαίστρα Κτιρίου: ΣΗ & ΕΙV	0.12	0.96	0.21	0.32	11.34	a / g	Σπουδακίτητα Κτιρίου: ΣΗ & ΣΙV	0,12	0.16	0.21	0.32	t
	Ζώνη Ιοσμκής Επι	ονδυνέκητα	Ç İ (EAKZ	(603)				Ζώνη Σεισμικής Επικ	NOUVONTRO	R (EAK2	003)		1
Euro (Avr	ιελεστής Σικομικής Επιβαρύνσεως ε επισμούς Κανονισμός 1850/84-850	50	06	0.08	0.12	0.16	Dire (Art	ελεστης Σεισμικής Επιβαρύνσεως ε ισεσμικός Κανονισμός 1959/84-85)	S 0	.06	0.08	0.12	
1430	Inoutaionna Knpiov II & II	D.	14	0.14	0.21	0.25	1.12	Σπουδασίτητα Κτιρίου: ΣΙ & ΣΙ	0.1	14	0.14	0.21	t
# /g	Σπουδαότητα Κηρίου 200 & ΣΙV	Û.	ta	0.21	0.32	0.54	# /g	Σπουδιαότητα Κηρίου. ΣΗ & ΣΙV	0.1	16	9.21	0.32	t
_	Zawy Zoopang Ema	w5.vompo	E III (EAKS	2003)				Ζώνη Σεισμικής Επικ	νδυκόπτριας	III (ISAK2	1003)		-
Euve (Ave	αλεστής Σεσιμικής Επιβαρίνστως ε ισεισμικος Κανονισμός 1959/84-85)		\$ 0.08		© 12	0.18	Euvr (Avra	ελατής Σοσμκής Επιβαρύνσους ε συσμικός Κανονισμός 1959/54-85)		\$0.0€		8.12	Γ
	Σπουδαιότητα Καρίου: Σ) & Σί		0.21		0.21	0.28		Σπουδαότητα Κτιρίου: ΣΙ & ΣΙΙ		0.21		0.21	t
# / R	Zmouðadimna Knolou: Zill & ZIV		9.28		0.32	0.34	4/8	Σπουδαάτητα Κηρίου: ΣΙΙΙ & ΣΤΛ		0.28	-	0.32	t

In buildings designed and/or constructed before 26/02/1959 as well as in buildings without a building permit, either partially or in their entirety, the seismic load factor e will be considered as the factor that should have been taken into account according to the Seismic Regulation of 1959, depending on the seismicity of the area (I, II, III) and the risk of the ground (a, b, c).

0.18

0.28

0.34

0.16

0.24

0.34

0.16 0.28

0.34

Len	a rict			Cano	d	Lealandan territer
De	fault	Write	TXT .	OK		Emiti = 0.0
10	0.450	1.619	L 133	1.619	٣	Tz = 0.12 Rds = 0.75
2	0.400	1.619	1.133	3.619		La salar a salar da s
٤	0.350	1.619	1.133	1.619		
7	0.300	1.619	1,133	1.619		
5	0.250	1.619	1.133	1.619		Emil = 0.0
5	0.200	1.619	1.133	1.619		Ty = 0.62
	0.150	1.619	1.133	1.619		
3	0.100	1.619	1.133	1.619		III
ź	0.050	1.619	1.133	1.619		
1	0.000	1.619	1.133	1.619	- 231	Zmi/M = 0.00
k/a∖	TUL	RdTa	RdTy	RdTr	^	Rds = 1.07

In case of application of non-linear methods of analysis, as provided for in the C.E.P.E., a horizontal elastic acceleration spectrum Se (T) shall be used, which shall be derived from the above-mentioned horizontal design spectrum Sd (T) (Figure 2 and Table 3) by setting k= to 1.0 and multiplying the values of the squares of the Sd (T) spectrum by a factor of 1.50 for buildings of the period ... < 1985 and by a factor of 2.00 for buildings of the period 1985 < ... < 1995, respectively.

For this reason, non-linear analysis methods are applied, check the **Περίοδος κατασκευής πρίν το 1985** checkbox on pre-1985 buildings.

ii. For buildings of category KII:

Σ.Ε. "Β" και Σεισμός Σχεδιασμού:	
 Σε περίπτωση εφαρμογής Γραμμικών Μεθόδων Ανάλυσης (σενάριο: EC8_ Σε περίπτωση εφαρμογής Μη Γραμμικών Μεθόδων Ανάλυσης (σενάριο: Ε Λαμβάνεται: 	Greek_Ελαστική, με Μέθοδο m ή q) :C8_Greek_Ανελαστική)
"Ως φάσμα σχεδιασμού και ελαστικό φάσμα, τόσο για τις οριζόντιες συνιστι συνιστώσα της σεισμικής δράσης, θα χρησιμοποιούνται τα φάσματα ότ αντίστοιχους Αντισεισμικούς Κανονισμούς ΝΕΑΚ & ΕΑΚ , λαμβάνοντας υπός ληφθεί υπόψη κατά τη φάση μελέτης του πυρόπληκτου κτιρίου, αναφορικά με:	ώσές όσο και για την κατακόρυφη τως αυτά παρουσιάζονται στους μη όλες τις παραδοχές που <u>είχαν</u>
Τη μέγιστη οριζόντια σεισμική επιτάχυνση εδάφους (Α=α.g) Το συντελεστή σπουδαιότητας του δομήματος (γi)	MA The- Mark M

In the case of buildings of category KI as design spectrum and elastic spectrum, both for the horizontal components and for the vertical component of the action, the spectra as presented in the respective NEAK & EAK, taking into account all the assumptions that were taken into account during the design phase of the fire-affected - earthquake-affected building...

Choosing category II activates the button of the EAC, while the fields related to category I are deactivated accordingly

\checkmark	Ελε	Ξγх	ος	Σε	ισμ	лоп	λήκ	стω	v -	Пц	роп	λήκ	των	1																								
Κατηγα	opio	зк	τιρ	ίων	, [Π		/		Περ	pioδα	ος κ	ата	ıσĸ	ເຣບເ	jς πρίν το 1985		EAK			???																	
<mark>Συντε</mark> Select	λεο	πή	ς	5510	σμι	кņ	; εг	nβα t	<mark>ipi</mark> o o	<mark>νσ</mark> ε ppe	ε <mark>ως</mark> en th	0 ne v	vin	do	°∎ w o	/g 0 of the paramete	<mark>Υπολ</mark> ers yo	λ <mark>ογισμός</mark> ou need t	Φ to s	<mark>åo</mark> set	<mark>µата</mark> to (ι <mark>ς</mark> cal	lcı	cu	٦li	la	ate	e t	he	e d	es	sig	'n	sp	ec	tru	un	n.
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M# (TX)	1				Ra	100	1.1				RATITA	3.4	-																									
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korzt	HTIA.	ANA	wan	a ri	ATTR	HC ET	Anci	IAI			OK.		. 0	*101	Ę																							

After you have set the parameters, press OK. The configuration window closes and you select



A/A	T(s	RdTx	RdTy	RdTz	^	Tx = 0.14 Rds = 1.07
1	0.000	2.354	1.648	2.354		Σmi/M = 0.00
2	0.050	4.120	2.884	4.120		
3	0.100	5.886	4.120	5.886		
4	0.150	5.886	4.120	5.886		r
5	0.200	5.886	4.120	5.886		Ty = 0.02
5	0.250	5.886	4.120	5.886		Σmi/M = 0.00
7	0.300	5.886	4.120	5.886		
в	0.350	5.886	4.120	5.886		
Э	0.400	5.886	4.120	5.886		
10	0.450	5.232	3.662	5.232	~	Tz = 0.18
Def	fault	Write	ТХТ	ОК		Rds = 0.75 Σmi/M = 0.00
Rea	TXT B			Cano	el	
	Ελεγχος Σ	εισμοπλήκτ	των - Πυρα	οπλήκτων		-
		πν		δος κατασ	κευής π	юіу то 1985 БАК

After calculating the spectrum, follow the procedure of analysis, elastic or non-elastic as explained in the previous chapters.

Εκτέλε	ση Pushover Ανάλυσης					×
	Παράμετροι	Κέντρα Μάζας	(cm)			~
	Αυτόματη Διαδικασία	Level	Х	γ	Z	^
		0 - 0.00	0.00	0.00	0.00	
V	Μάζες-Ακαμψίες	1 - 300.00	1356.05	300.00	950.00	
\checkmark	Στατική-Δυναμική	2 - 600.00	1356.05	600.00	950.00	
\checkmark	Pushover	3 - 900.00	1345.14	900.00	950.00	
		4 - 1200.00	968.29	1200.00	950.00	
		5 - 1500.00	968.29	1500.00	950.00	
		6 - 1800.00	968.19	1800.00	950.00	
						~
	Ενημέρωση Δεδομένων	,	Εξο	δος		

3(a).3.3 Automatic Procedure

Before performing the procedure, the value of the coefficient of the mobile loads ψ 2 must be set.

The default value is ψ2=0.30.

Συντελεστές ψ2		Κέντρα Μάζας (cm) Υψόμετρα (cm) Συντελεστές ψ2
Level	Ψ2	Σεισμικοί Πολλαπλασιαστές Διαστάσεις (m)
0 - 0.00	0.30	Μάζες (kN)
1 - 400.00	0.30	
2 - 700.00	0.30	
3 - 1000.00	0.30	

This process includes 3 steps which are executed sequentially, either automatically with the Automatic Process or selectively by choosing the keys one by one.

- 1. Calculation of masses and stiffnesses.
- Perform a static analysis to calculate the intensities of permanent and mobile loads required to initiate the successive pushover analyses.
 Performing a corresponding dynamic with the EC8 elastic design spectrum to calculate the eigenmodes and target displacement.
- **3.** Performing Pushover analyses.

In this example the automatic procedure was chosen, 4 seismic combinations with 2 distributions and 200 steps for each Pushover, a total of 1600 analyses approximately!

EXAMPLE 6: "STUDY FOR THE VALUATION AND REDESIGN OF A BUILDING ACCORDING TO THE CANC.

- Σεισμικοί συνδυασμοί			
Fx +k Fz	🗹 Τριγωνική Κατανομή		
Fx - k Fz	Ορθογωνική Κατανομή		
🖌 -Fx + k Fz			
-Fx - k Fz	Τυχηματικές εκεντρότητες Εχ		
🖌 Fz + k Fx	🗌 Τυχηματικές εκεντρότητες Εz		
Fz-kFx ✔-Fz+kFx	🗌 Επιλογή Τέμνουσας Βάσης Από Φάσμα Σχεδιασμού.		
-Fz - k Fx	Συντελεστής Εγκάρσιας Φόρτισης (k) 0.3	Αριθμός Βημάτων	200

After the analysis process is completed, the following are:

- 1. The creation of the Pushover combinations (for sizing of reinforcements)
- 2. The appearance of the results (to investigate failures)

3(a).4 PUSHOVER Analysis Combinations



Press the **Combinations** command to open the combinations window, to create the combinations of loadings for fixed and mobile only (2 loadings)

G	1.35	γE	1		≪ [1		ψ2	0.3	¢.			Αστο)	dac G+y	Q+Σyψ0Q	10	urroupyekómm ∑SG+Q+Sµ0	R Q		Yashay	NS-0C
Q	1.5	VE0.3	0.3						Avenoc -	Xerre		⊠26	i+ψ1 i+Ε+	Q+2ψ2Q 2γψ2Q	0.00	⊴3G+#/3Q+8 ⊴3G+5#2Q	ψ2Q	1	Δογραφί	holu
		Ειδος		∆urû€u	μαη	LC1		1.02	-		103			1,04		LCS		LCfi		LC
Irvé	ipio					EC-8_Gr		EC-I	Gree.		EC-B	Gren	٠	EC-B_Gree	٠	EC-8_Gree	-	EC-B G		EC
Dóp	τιση					1		2	13	n	0	States	-	0		Ð		0		G
Tún	90					G	5	Q	EC-8	Gree	k Aut)	LOUTER	5 (0)	G	•	G		6	1	G
Δρά	οεις							Kon	ηγορία.				٠		٠	1				•
Περ	ψραφή																			
Tuni	61	Arrovio		0w		1.00		0.30												ļ
Fuul	6.0	2010/10		1 VA		1		0.50												-
Luvi	5.3			i		Î		-												-
Euvi	5.:4			1		1		-												+
Iuvi	5.5			1		1		1												+
Euvi	5.6			1		1														T
Euve	5.:7			1		1														
Euvi	5:8		*	1		1														
Euvi	5.9			1		1														
Inni	510			[-	1														
Invi	5211					1														T
Tuvi	5.12					1														
¢				***																>
		_	_			100		and here	141	_					_	1 Te			i marine	

I Notes: The coefficients of G and Q are automatically filled in according to the **Data Reliability Level** selected in Parameters, as long as you select Predefined Combinations.

The coefficients of the required failure combination are filled in and entered (with the corresponding name) automatically.

	ocar pisk (L) + MELETES + pushover + scanna	0	Search maarial	P
Diganize * New fold	er			F. 0
- OneDrive	Name	Daty modified	Type	Sire
In This Of	Scen000	22/3/2016 10:43 mil	File tooter	
C 6100 Drive	3 Scen001	22/5/2016 10:43 10	File fondex	
ASCO LIVE	Scen002	23/3/2016 12:35 µµ.	File funder	
B Destop	Scen003	23/3/2016.2341.66	File fielder	
Documenta	I Scen004	34/3/2016 10:34 ны	File (code)	
Downloads	default.cmb	24/3/2016 1246 ppc	-CMETPH	74
Music	EC-8_Greek AveAantwij (4).cmb	23/3/2016-4:17 (4)	-CMB Film	7.8
In Pictures	EC-8_Greek Examuel Static (3).cmb	21/1/2016 2:35 pp	CME File	53.0
E Videos	EC-8_Greek Rpodkeygoc Static (210th	23/3/28116 12:31 pai	CMEFile	53.6
L. Loral Disk (C) -	6			
File name:				
Save as type: Scad	a Combination(*.ceibi			

Then through the parameters of the Anelastic scenario in the section "**Seismic** Combinations"

- Σεισμικοί συνδυασμοί	
Fx +k Fz	🗹 Τριγωνική Κατανομή
Fx - k Fz	🗹 Ορθογωνική Κατανομή
✓ -Fx + k Fz	
🗌 -Fx - k Fz	Τυχηματικές εκκεντρότητες Εχ
🗹 Fz + k Fx	🗌 Τυχηματικές εκκεντρότητες Εz
☐ Fz - k Fx ☑ - Fz + k Fx	🗌 Επιλογή Τέμνουσας Βάσης Από Φάσμα Σχεδιασμού.
-Fz - k Fx	Συντελεστής Εγκάρσιας Φόρτισης (k) 0.3

We define the combinations for which inelastic analyses will be performed. Each combination means that a seismic force will be applied in the specific direction (x or z) with a factor of 1 and a seismic force in the transverse direction with a factor that you specify in the "*Transverse load factor*" field.

<u> The default value is 0.3.</u>

We also determine the type of distribution of the seismic force along the height of the building (Triangular or Rectangular). <u>The CANPE requires both seismic distributions.</u>

Also, if we want to take into account, in addition to the seismic forces, moments resulting from the accidental eccentricities, then we activate the fields "*Accidental eccentricities Eh and Ez*".

Then, for the sizing of aid, you will also need to define the combination and distribution in the "Select analysis for aid control" field of the "Controls" command.

E	πιλογή Ανάλυσης για Ελεγχο Ενισχύσεων	
	Fx+0.30*Fz - Τριγωνική	~
	Fx+0.30*Fz - Τριγωνική	
	-Fx+0.30*Fz - Τριγωνική	
S	Fz+0.30*Fx - Τριγωνική	
\sim	-Fz+0.30*Fx - Τριγωνική	
	Fx+0.30*Fz - Ορθογωνική	
\leq	-Fx+0.30*Fz - Ορθογωνική	
	Fz+0.30*Fx - Ορθογωνική	
1	-Fz+0.30*Fx - Ορθογωνική	

3(a).5 PUSHOVER Analysis Results

When applying the pushover analysis, the structure is gradually extruded with monotonically increasing lateral load (triangular or rectangular) until it reaches failure. Plastic joints are thus gradually formed at the ends of the component elements (beams, columns, walls) of the whole structure.

As these form, the strength of the nodes at the beginning and end of the element's length is gradually reduced. In the final steps of the analysis, a collapse mechanism will be created by the forming plastic joints in the structural elements of the structure, whose plastic deformations will be such that the elements not be able to receive further stress and the structure will be driven to failure.

The designer has the ability to view the results of all Pushover analyses in the form of diagrams and also display the visualization of the carrier as it responds to Pushover:



The 3D initial and deformed model of the vector is displayed on the desktop and the "Report" dialog box opens.



In the "Control Node" field you specify the number of the control node on the basis of which the resistance curve will be calculated.

This node is usually the bulkhead node of the last full floor of the building. If there is no bulkhead, choose
a perimeter node

from the same level.

• You can select another control node to view the results without having to run the analysis script again. The results

are automatically updated.

Κόμβος Ελέγχου	63
-------------------	----

In this example, the Control Node is 63.

Report				×
Τριγωνική	✓ Fx+0.30*F	z	~	Φάσμα
Βήμα Vb(kN) (λ)		Ελεγχος	' 0 '	Ταράμετροι
17. 1165.581 (0.2223	36) ~ >	> Διαδοχική	εμφάνιση ν αρθοώσει	A-DL
Κόμβος 63 Κα	ωπύλη Ικανότητας	Κατασκευής		B-SD
Ελεγχου				Γ-NC
1800 Vb(kN)				
1700			000-00-0	0000
1500		and and all		
1400	16:1142.3659,	0.0640		
1200		_		
1000	P 45			
800				
700				
500				
300				
200				
				UX(M)
	0.10	0.16	0.20	0.25
Δημιουργία διαγραμμ	ιάτων για τεύχος με	λέτης - Ελεγχοι	ΤΧΤ Αρχ	είο Εντατικών
	Διάγραμμα Ροπής	- Στροφής Μέλου	ς	

At the top of the window

Report		×
Τριγωνική ~ Fx+0.30*Fz	~	Φάσμα
Βήμα Vb(kN) (λ)	Ελεγχος 'θ'	Παράμετροι
17. 1165.581 (0.22236) × >>	Διαδοχική εμφάνι	ση A-DL
Κόμβος 63 Καμαύλη Ικανότητας Κατα	ακεμός	B-SD
Ελέγχου	Joncon Iç	Γ-NC

select one of the distributions, which you had previously set to be included in the

window of the configuration,	Τριγωνική Τριγωνική Ορθογωνική ar	nd respectively	a of	their and of
	Fx+0.30*Fz			
default combinations	Fx+0.30*Fz -Fx+0.30*Fz Fz+0.30*Fx -Fz+0.30*Fx	and		
Bήμα Vb(kN) (λ)	v			

in the list the steps of the specific anelastic analysis are displayed and for each step the cutting force Vb(kN) and the corresponding minimum load factor (λ) are shown, while at the same time they are formed:

- Capacity curve of the construction
- Bilinear Capability Curve
- Targeted Movement

Καμπύλη Ικανότητας Κατασκευής	•
Καμπύλη Ικανότητας Κατασκευής	
Διγραμμική Καμπύλη Ικανότητας	
Στοχευόμενη Μετακίνηση	

3(a).5.1 Capability Curve

It expresses the non-linear relationship between the imposed horizontal load and the displacement of the Control Node.

EPE 7.1.2.2.1 Intensity-Deformation "F-d" curve

α) The mechanical behaviour of a structural element, a critical region of a structural element, or a connection of elements (node), is described by means of a diagram of stress 'F' versus strain or relative displacement 'd'. The type, direction, etc. of the magnitude F shall be chosen so as to characterise the main part of the stress caused by the seismic action on the element, critical region or connection. The deflection δ shall be chosen so that, in combination with the intensity magnitude F, expresses the deformation energy of the element, critical region or connection.

On the Resistance Curve, the "Steps" of the pushover analysis are formed in the form of points. The selected step is shown in pink and represents the creation of a plastic joint (i.e. when the shear stress at Control Node X has a value Vb then the first plastic joint is created).



Moving the mouse to the step points displays the step number and the corresponding Vb and Ux values.

3(a).5.2 Bilinear Capability Curve

This is the corresponding bilinear curve calculated either in the simplified way provided for by the CEEAP, or by calculating equal areas. The key concerns the definition of the parameters for the way of bilinearisation of the capacity curve of the structure.

CAN.EPE 5.7.3.4 Idealised force-mobility curve

The non-linear force-displacement relationship linking the base shear and the displacement of the control node (§5.7.3.1a) shall be replaced by an idealised curve to calculate the equivalent lateral stiffness Ke and the corresponding yield strength Vy of the building.



curve. This bilinear curve is necessary so that the slopes of its two branches can be used to calculate the eigenperiod and the corresponding spectral acceleration.

Selecting it displays the following dialog box

Παράμετροι EC8 - KANEPE	×
Μέθοδος Διγραμικοποίησης	
Vy= 80 Vmax (80%)	
Ανηγμένη κλίση (α) δεύτερου κλάδου (max=0.10) 0.1	
Υπολογισμός Ισων Εμβαδών 🛛 🗸	Απλοποιητική (& 5.7.3.4) Υπολογισμός Ισων Εμβαδών
Ke = 60 Vmax (60%)	
Τύπος Φορέα για τον Υπολογισμό των C1-C2	
C1 Κτίρια με Μικτό Σύστημα	Κτίρια με Μικτό Σύστημα Κτίρια με Αμιγώς Πλαισιακό Σύστημα
C2 (Πιν.Σ5.1) Κτίρια Τύπου 1	Κτίρια Τύπου 1 Κτίρια Τύπου 2
Εκταση Βλαβών για τον υπολογισμό του γSd (Σ.4.2)	
Εντονες & Εκτεταμένες Βλάβες-Επεμβάσεις 📎	 Εντονες & Εκτεταμένες Βλάβες-Επεμβάσεις Ελαφρές & Τοπικές Βλάβες-Επεμβάσεις Χωρίς Βλάβες & Χωρίς Επεμβάσεις
OK Cancel	5

(CAN.EPE)§5: The idealized resistance curve (force-displacement relationship) is recommended to be bilinear (see also §7.1), with slope of the first branch Ke and slope of the second branch equal to α Ke. The two lines constituting the bilinear curve may be determined graphically, on the basis of the approximate equality of the areas of the spaces above and below the intersections of the real and idealised curves (Fig. 5.2).



There are two methods for calculating the bilinear curve:

- 1. The "simplifying" one, with values as provided by the EIA and entered in the parameters discussed below
- 2. The "method of equal areas", where these parameters are used as starting points for determining the bilinear.

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(CAN.EPE)§5: The equivalent lateral stiffness Ke is obtained as the occupant stiffness corresponding to a force equal to 60% of the yield strength Vy which is defined by the intersection of the lines mentioned above. The reduced slope (a) of the second branch is determined by a line passing through the point of the (real) non-linear resistance curve corresponding to the failure displacement (δu), beyond which a significant reduction in the strength of the beam is observed (Fig. In all cases the resulting value of α must be positive (or zero), but not exceed 0.10 (to be compatible with the other assumptions of the δt estimation method, such as the coefficient C1, see Fig. 5.2). § 5.5.2b and § 5.7.4.2a). The recommended value for the percentage reduction in strength is 15%, provided that no failure of a main vertical element has occurred at this level (in which case the bilinearisation shall be performed at the displacement corresponding to this failure). Simplistically, and since no estimation of the available ductility of the building is required, the slope Ke can be taken as the passenger value for a resistance level equal to 60% of the maximum resistance (Vmax), and the yield strength Vy, for the calculation of the R index relation (S5.7), as 80% of Vmax.

Vy= 80 Vmax (80%)

The first parameter concerns the slope of the second branch, which is:

- With the simplification method: constant
- By the method of equal areas: as a starting slope.

With a value of 0 the second branch will be drawn horizontally in both methods.

60 Vmax (60%) Ke = ۵

The Ke option refers to the starting slope of the first branch, which is:

- With the simplification method: constant
- By the method of equal areas: as a starting slope.

Ανηγμένη κλίση (α) δεύτερου κλάδου (max=0.10) 0.1

The neglected slope (a) refers to the second branch:

۵

۵

- with a value of 0, is automatically calculated with a limit of 0.10 as provided for in the EIA, while
- with a user value, is plotted fixed at that slope.

The default values of the program are the values provided for in the CAN.EPE.



In the section "Type of building for the calculation of C1-C2" you select the type your building to calculate the above factors which are used for the calculation of the targeted movement.

(CAN.EPE)§5.7.4.2: The target movement δt is allowed to be calculated based on the following relation (S5.6) and corrected as follows: $\delta t = C0 C1 C2 C3 (Te2/4\pi2) Se(T)$ (25.6) where Se(T) is the elastic spectral pseudo-spectral acceleration (from the spectrum of EC 8-1) corresponding to the equivalent eigenperiod of the structure Te (calculated from the inflexion point of the force-displacement diagram of the, as defined in § 5.7.3.4), and CO, C1, C2 and C3 are correction factors defined as follows:

- C0: Coefficient relating the spectral displacement of the equivalent elastic carrier with stiffness Ke (Sd=[Te2/4π2] · Φe) to the actual displacement δt of the peak of the elasto-plastically responsive carrier. (§5.7.3.4). Its values may be taken equal to 1.0, 1.2, 1.3, 1.4, 1.5, for numbers of floors 1, 2, 3, 5, and ≥10, respectively.
- The ratio C1=δinel/δel of the maximum inelastic displacement of a building to the corresponding elastic displacement may be obtained from the relationships: C1=1.0 for T≥ Tc, and

C1=[1.0+(R-1)Tc/T]/R for T < Tc, where Tc is the value at which the bad branch of the response spectrum begins (see EC 8-1) and R=Vel/Vy is the ratio of the elastic demand to the yield strength of the carrier. This ratio can be estimated from the relation R= ($(\Phi e/g)/(Vv/W)$).Cm, (Σ 5.7)

in which the leakage resistance Vy is calculated by appropriate bilinearisation of the force (base shear) - displacement (top) diagram of the building, as defined in § 5.7.3.4.

Simplifying (and on the safety side), the ratio Vy/W in relation (S5.7) can be taken as 0.15 for buildings with a mixed system, and 0.10 for buildings with a purely framed system.

C2:	Coefficient taking into account the	Πίνακας	; <i>Σ5.1</i> : Τιμέ	ές του συντ	ελεστή C2		
influence of the shape of the hysteresis loop at maximum movement. Its values can taken from Table		Στάθμη επιτε) εστικότητας	T =	0.1s	$T \geq T_2$		
		entieneotikotijius	φορέας τύπου 1	φορέας τύπου 2	φορέας τύπου 1	φορέας τύπου 2	
linea	r interpolation shall be used.	Άμεση χρήση μετά τον σεισμό	1.0	1.0	1.0	1.0	
		Προστασία ζωής	1.3	1.0	1.1	1.0	
	Εκταση Βλαβών για τον υπολογισμό του γ	Αποφυγή οιονεί	1.5	1.0	1.2	1.0	
*	Εντονες & Εκτεταμένες Βλάβες-Επεμβάσ	εις					

Finally, in the section "Extent of damage for the calculation of γ Sd" you select the extent of damage in your building in order to take into account the appropriate safety factor of the γ Sd actions

Πίνακας Σ 4.2: Τιμές του συντελεστή γsd

Έντονες	και	Ελαφρές	και	Χωρίς	βλάβες	και
εκτεταμένες	βλάβες	τοπικές	βλάβες	χωρίς ε	πεμβάσε	ıς
ή / και επεμβ	άσεις	ή / και επε	μβάσεις			-
γ _{Sd} =1,2	20	$\gamma_{sd} = 1$	1,10	γs	_{id} =1,00	

Βλ. και Παράρτημα 7Δ περί βλαβών και φθορών.

NOTE: It should be noted that any changes you make to the "Spectra" and "Parameters" options do not require you to run the analysis script again. The results are updated automatically.

IN SUMMARY: From the analysis of the simulation, the resistance curve of the structure is constructed, which expresses the relationship between the base shear, the building and the peak displacement, d. Based on this curve, all the required checks are made to satisfy the performance criteria. For the determination of the target displacement, however, it is necessary to replace the resistance curve by an idealised bilinear curve from which the equivalent lateral stiffness, and the corresponding yield shear stress, is determined. The target displacement of the structure is calculated for a given earthquake return period according to CEE (see Section 4.1.1.1.1.1.1.2). Chapter 5 §5.7.4). After the expected displacement of the top of the structure has been calculated, the corresponding performance point is marked on the curve and compared with the desired level for the specific seismic excitation.

3(α). 5.3 Targeted Movement

The three targeted movements, one for each level of performance.

EIA 5.7.4.2 Targeted movement

 α . The target displacement δt (§5.7.1.2) shall be calculated by taking into account appropriately all factors affecting the displacement of an inelastic responding building. It is permissible to consider the displacement of an elastic singlestage system with an eigenplane equal to the fundamental eigenplane of the building (§5.7.3.5) subject to the seismic action for which the check is being made, with an appropriate correction to obtain the corresponding displacement of the elastically responding building...

CAN.EPE 2.2.1 General

 α . In order to serve wider socio-economic needs, various measures are introduced to "performance levels" (target behaviours) under given corresponding design earthquakes. 8. The assessment or redesign objectives are combinations of a performance level on the one hand and a seismic action on the other hand, with a given "tolerable probability of exceedance during the technical lifetime of the building" (design earthquake).



C-NC give the deformed state of the vector for the three performance levels The options and respectively, i.e. they show the deformed vector at the analysis step where the control node movement is equal to the corresponding target one. The blue dotted line corresponds to the target displacement for the first performance level and the yellow and red for the second and third respectively For this example, for a triangular distribution and for the combination -Fz+0.30*Fx

Τριγωνική 💌	-Fz+0.30*Fx	•
-------------	-------------	---

the steps of the analysis corresponding to the three levels are:





L-NC Performance level Step 89



Moving the mouse to the points Displays the values for the three targeted movements, one for each performance level and the corresponding intersections at the Control Node.

Φάσμα

button displays the same dialog box as the one in the original script parameters.

It should be noted that these parameters, because they relate to the calculation of the target displacement, can be set or modified after the inelastic analysis has been run, without the need to re-execute it. The same applies to the control node.

You can select another control node here without having to run the analysis again. The program automatically displays the results for this node.

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Φάσματα	×
· · · · · · · · · · · · · · · · · · ·	
Στόχοι αποτίμησης ή ανασχεδιασμού Φέροντος Οργανισμού Α1 Β1 Γ1 1	.00 ~
Ζωή σχεδιασμού (έτη) 50 🗸 Εκθέτης k (3.0)	3
Περιορισμένες Βλάβες (Α - DL)	
☑ Ελεγχος Εδαφική επιτάχυνση ag=AgR.γΙ.(TR/TLR)1/k	0.16
Υπολογισμός TR	
Περίοδος επαναφοράς TR (έτη) 475 Πιθανότητα υπέρβασης PLR%	10
Πιθανότητα υπέρβασης PR % 10 Περίοδος επαναφοράς TLR (ἐτη)	475
Σημαντικές Βλάβες (Β - SD)	
Ελεγχος Εδαφική επιτάχυνση ag=AgR.γI.(TR/TLR)1/k	0.16
Υπολογισμός TR	
Περίοδος επαναφοράς TR (έτη) 475 Πιθανότητα υπέρβασης PLR%	10
Πιθανότητα υπέρβασης PR% 10 Περίοδος επαναφοράς TLR (έτη)	475
Οιονεί Κατάρρευση (Γ - ΝC)	
Ελεγχος Εδαφική επιτάχυνση ag=AgR.γI.(TR/TLR)1/k	0.16
Υπολογισμός TR	
Περίοδος επαναφοράς TR (έτη) 475 Πιθανότητα υπέρβασης PLR%	10
Πιθανότητα υπέρβασης PR% 10 Περίοδος επαναφοράς TLR (έτη)	475
Προεπιλογή	
KANEΠΕ 10% KANEΠΕ 30% EC8 2% EC8 10% EC8	3 20%
OK	
Cit	

INOTE: the printout of the cross-section adequacy checks in terms of deformation now shows in detail the quantities (Ci and the rest) used to calculate the target displacement.

											Σελίδα : 1
ΑΠΟΤΕΛΕΣΜΑΤΑ ΕΛΕΓΧΩΝ											
ΣENAPIO :	ΣΕΝΑΡΙΟ : ΑΝΕΛΑΣΤΙΚΗ										
Είδα	ος Αν	άλυσης - Κα	τανομής	:			Fx+(0.30*	Fz - Τριγωνικ	κή ((1)
Κανονισμός	για το	ον υπολογισ	μό της στ	οχεύομε	νης	ς μετακίν	/ησης	:	KA	N.E	ENE.
ΕΛΕΓΧΟΣ ΕΠΑΡΚΕΙΑΣ ΦΟΡΕΑ ΣΕ ΟΡΟΥΣ ΠΑΡΑΜΟΡΦΩΣΕΩΝ											
			C0	C1		C2	C3		Se(T) (m/sec2)		Te (sec)
Περιορισμένες Ε	Βλάβες	ς (A-DL)	1.20	1.1	17	1.00		1.00	7.0)6	0.33
Σημαντικές Βλά	βες	(B-SD)	1.20	1.1	17	1.24		1.00	7.0)6	0.33
Οιονεί Κατάρρε	υση	(F-NC)	1.20	1.1	17	1.41		1.00	7.0)6	0.33
			Στοχευ Μετακ dt(c	όμενη ινήση :m)		Συνολικ Μετακινή dm(cm	:ή ση)	λόγος λ=dt/dm			ΕΠΑΡΚΕΙΑ
Περιορισμένες Ε	Βλάβες	ς (A-DL)		2.69			8.24	0.33			Ναι
Σημαντικές Βλά	βες	(B-SD)		3.33			8.24		0.40		Ναι
Οιονεί Κατάρρε	υση	(F-NC)		3.78			8.24		0.46		Ναι

3(a).6 Illustration of the operator

The program also allows you to see in real time the deformation state of the beam and the edges of the cross-sections where plastic joints are created, for each step of the analysis.

There are two methods of imaging the vector.

1. The first way is by selecting a step from the list

Βήμα Vb(kN) (λ)

78. 2730.28463 (0.11149)

(the selection becomes blue) and you will see for this step the state of the carrier and the points of plastic joints.

The original, undeformed state of the carrier is shown in grey. The deformed carrier is shown in red and the coloured dot shows the edge of the plastic joint.

This dot, <u>depending on the size of the turning angle of the plastic joint</u>, is coloured in three colours.

Blue when

$$S R \leq = \frac{\partial}{\partial} \frac{p^{l}}{q} = 0.5 \frac{p^{l}}{p^{l}} = 0.5 \frac{\partial}{\partial r^{l}} - \frac{\partial}{\partial r^{l}} - \frac{\partial}{\partial r^{l}}$$
Yellow when
$$0.5 \frac{\partial}{\gamma_{Rd}} = 0.5 \frac{\partial}{\gamma_{Rd}} \leq .S_{d} \leq R_{d} = \partial_{d}^{p^{l}} = \frac{\partial}{\gamma_{Rd}} $

Red when

$$S_{d} \geq R_{d} = \theta_{d}^{pl} = \frac{\theta_{pl}}{\gamma_{Rd}} = \frac{\theta_{pl}}{\gamma_{Rd}}$$



EXAMPLE 6: "STUDY FOR THE VALUATION AND REDESIGN OF A BUILDING ACCORDING TO THE CANC.

In addition, the sea blue squares that appear at the ends of the elements indicate shear failure.

At the end of the member that fails by shear, the box appears, while in the next step the program creates a plastic joint at this point with simultaneous reduction of θy as provided by the CEE for the elements that fail first by shear, and continues the process of completing the pushover analysis.

2. The second way of visualization is to select the first step and by pressing the button you can see the vector in motion with the creation of the plastic joints. You end the command by selecting the same key again. The same effect can be achieved by selecting a step and turning the mouse wheel.

The options, A-DL B-SD, and reverse give the deformation state of the vector for the three performance levels respectively, i.e., they show the vector at the analysis step where the control node movement is equal to the corresponding target movement.

At the bottom of the window

	-	-	-	-		
Δημιουρ	γία διαγραμμάτων	/ για τεύχος με	ελέτης - Ελεγχα	ΤΧΤ Αρ	χείο Εντατικών	
Διάγραμμα Ροπής - Στροφής Μέλους						

the selection of the key

Δημιουργία διαγραμμάτων για τεύχος μελέτης - Ελεγχοι

is **necessary** to create the necessary prints and controls and to update them after possible changes (e.g. bilinearization method, change of spectra, change of parameters, etc.).

• the selection of the key

displays the file containing the lists with :

- Displacements and Junction Rotations for all junctions per direction
- Intensive Member sizes at the beginning and end of each member
- Active stiffnesses for each Pillar and each Beam
- the selection of the key

displays the torque-torque diagram of the member which is shown by member (start - end) and by direction.

I. Member torque - turn diagram

By selecting the command	Διάγραμμα Ροπής - Στροφής Μέλους	and					
then pointing with the left mouse button to a member of a column or beam, the torque - rotation diagra member is opened, which is displayed per member (start - end) and							
	Report						
per address for the selected distribution	Τριγωνική ~ Fx+0.30*Fz	~					

• A prerequisite for the display of the torque - rotation diagrams of a member is that the Checks have been previously performed, i.e. the command has been selected:

Δημιουργία διαγραμμάτων για τεύχος μελέτης - Ελεγχοι

The skeletal diagram is a strength diagram of the end of the member. The critical quantities to be drawn are Fy, θ y and θ u.



Σκελετικό Διάγραμμα Συμπεριφοράς (για τα επιμέρους δομικά στοιχεία, ή το δόμημα – ως σύνολο)

In SCADA θy or dy is 0. What is shown is :



It has no sloping anionic elastic branch so $\theta y=dy=0$ but you do NOT show the value of θu or du on the diagram. It was preferred to show, for better overview, the boundaries of the B and C performance stations.

OBSERVATION:

Note that the printout now includes (for concrete & M.I.P.) ONLY those elements that have developed a plastic joint at one or both ends up to the step corresponding to performance level C.

That is, those which in all steps do NOT develop a plastic joint at any of their ends and those which do, but at a step larger than the step corresponding to the C level of performance are NOT printed.



This diagram is based on the following assumptions:

- The calculation of the moment My is based on relation (A.6) of Annex 7A of CEE/CNR.
- The value of My is different for each step, due to the axonics involved in its calculation. In the skeletons of the masonry members and in the skeletons

for concrete members the skeleton is calculated with the axial of each step.

• Two values of My (positive and negative) are calculated and two values of My are plotted respectively. areas with thresholds (different) for the performance levels.

For poles, due to the existence of symmetrical reinforcement, the two values will always be the same.

- As is known, the diagram does not have an elastic branch and shows only the corresponding plastic area.
- The values of θ have been divided by the corresponding safety factors. The θpl limits corresponding to the
 performance levels have been divided by the factor

 γrd and the turning angles θsd have been multiplied by the γsd factor.

2										Σελίδα : 1
				ANOTE/	ΕΣΜΑΤΑ	EVELX	ΩN			
ΣENA	PIO :				A	ΙΕΛΑΣΤΙΚΙ	H.			
E	Είδος	Ανάλυση	ς - Καταν	ομής :			Fx+0.30	Fz - Tpiyan	rikt) (1)	
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		10000000			- 141	- Set		(m/sec2)		(sec)
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nµavia Oliveria	κες Βλαβει	(B-SU	η	1.20	1.1/	1.24	1.00	1	063	0.3
DIDVEL N	Carappenoi	1 11-196-1		1.20	1.17	1.44	1.00		00	0.3
			1 3	Στοχευάμε	tvή	Συναλική	5	λάγος	122/5	1992-19V
				du com)	αŋ	dm(cm)	M	à=dildim	EHA	PREIA
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ξημαντα	KEC BAGBE	(8-50))		3.33		8.24	0.4	0 1	Nai
Diovel N	ζατάρρευσι	T (T-NC)			3.78		8.24	0.4	6 1	Max.
	EAEC		PKEIAT	AIATON				PROTEON	(mrad)	
_	AOKO	NOL CIT	u numu	APT1 01	Ey-	+0 30*Fz-	Tanuan	vn (1)	(funda)	_
	Lono	Drown	oigutivec B	ABBer .	1 Xnur	WINK AN BA	ABAC	Olovi Olovi	Keténer	udo
(A - DL) (B - SD)					oper	CION	(T-NC)	0001		
Μέλος	Κόμβος	ysd'8sd	Bpl/yrd	Επαρκεί	ysd"0sd	0pl/yrd	Επορκεί	ysd*8sd	6pi/yrd	Emopeci
27	14	0.00	0.00	Nus	0.00	10.58	Nui	0.00	21.1/	Na
- 14					0.0	000		0.00	IQ.	
	12	0.00	0.00	Dyr.	0.00	10.58	Nai	0.00	21.17	Nai
30	44	1.01	0.00	100	1.04	0.04	him	0.00	17 00	Rin:
30		1.01	0.00	V20	1.01	0.34	1400	0.10	17.00	Pagat
	12	0.00	0.00	Nai	0.00	8 94	Nm	0.00	17.88	Na
		-			0.0	001	1.000	0.00	0	
32	15	0.00	0.00	Nai	0.00	10.03	No	0.00	20.05	Nai
		p (40)	1000	S. 61-5	0.0	00	1.000	0.00	10	
	9	-0.00	0.00	D _X (-0.00	10.03	No	-0.00	20.05	Nai
		1	1		0.0	000	-	0.00	0	
33	15	0.00	0.00	Dg	0.00	9.70	Nω	0.00	19.40	Nai
_	40	0.00	0.00		0.0	000		0.00	10	
	10	0.00	0.00	Ngi	0.00	3.70	NO	0.00	19.40	real
35	10	1.50	0.00	Det	150	8 10	Noi	1.50	16.21	Na
	10	1.20	0.00		0.1	185		0.05	13	1941
	14	0.00	0.00	Nai	0.00	8.75	Nm	0.00	17.50	Nai
		1			0.0	00		0.00	0	
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-	ETYAO	I NOL LI			Fx	+0.30°Fz	Towww	K/1 (1)		
-		Перио	proužvec B	λάβες	Σημα	WINKEC BA	àBec	Oibvs	i Kardoor	uan
			(A-DL)	10.61		(B - SD)	Read Press		(F=NC)	28
Μέλος	Κόμβος	ysd"8sd	0pVyrd	Επαριεί	sed"0sd	0pl/yrd	Επαριτί	ysd*8sd	8pl/yrd	Emopecti
t	1	-5.80	0.00	D ₂₀	-5.80	0.67	Dy0	-5.80	1.35	Ūχi
	0		1.11	0.00	8.6	500	1	4.30	0	
	8	-6.06	0.00	0,0	-6.06	0.67	Οχι	-6.06	1.35	UXI
					8.5	384		4.49	2	

This was done to ensure compatibility with the corresponding print results.

The diagram shows the angle of rotation of the plastic joint (requirement) for the three steps of the analysis corresponding to the three levels of performance:

A:blue B:orange C:red

The values are displayed, depending on the sign of the angle, in the corresponding area.

In the dialog box that appears:

The corresponding diagram is shown for each end (Start-End).





The address is selected from the corresponding field .

• For beams in particular, the default direction is the principal direction z, but with the assumption that the angle of rotation of the plastic joint is the worst case of both directions.

Two coloured areas appear, one positive and one for negative values of the axis, where **blue** represents the **B** level of performance and **brown** the **C** level respectively.

The values in **black** are the **limits** for each performance level.

 In the diagram they are shown as integers, but in the bottom right-hand part for negatives and in the top left-hand part for positives, they are written with their decimal places.

The colours that appear in the circles at the ends of each member in the 3D vector depend on where the corresponding angle of rotation of the plastic joint is located.

More specifically:

No value means that: the limb has not developed a plastic joint.



The **blue** colour means that: the corresponding blue line is within the blue area, i.e. the limit of A (which is 0) has been exceeded, but both it and the other two values have not exceeded the limit of B (blue area).



The yellow colour means that the corresponding value (orange line) has entered the brown area and the corresponding red one has not left the brown area.



Finally, the **red** colour means that the corresponding **red** value is outside the brown area.



• All of the above is valid provided that the actor is at the step corresponding to the C level of performance, so that all of the above has been developed.

The ductility indices in terms of the angle of twist $\mu\theta$ for each level of performance are also given. The required one is given first, followed by the available one in brackets.

The sizes are displayed in red when the first value is greater than the second. For the first performance level is mthA=1.

3(a).7 Creation of diagrams for study booklet-Checks

Finally the selection of the button

Δημιουργία διαγραμμάτων για τεύχος μελέτης - Ελεγχοι

is **necessary** to create the necessary prints and controls and to update them after possible changes (e.g. bilinearization method, change of spectra, change of parameters, etc.)

3(a).8 PUSHOVER Analysis Checks



After selecting the button

Δημιουργία διαγραμμάτων για τεύχος μελέτης - Ελεγχοι select the command

"Checks" and the following dialog box appears:

	Είδος Ανάλυσης - Κατανομής		DL			SD			NC		Εκτύπωση	
		Δ	к	Σ	Δ	к	Σ	۵	к	Σ		
1	Fx+0.30*Fz - Τριγωνική	33	64	97	1	13	14	0	0	0	•	
9	-Fx+0.30*Fz - Τριγωνική	27	62	89	0	0	0	0	0	0	•	m
17	Fz+0.30*Fx - Τριγωνική	41	49	90	0	0	0	0	0	0	•	
25	-Fz+0.30*Fx • Τριγωνική	31	65	96	0	0	0	0	0	0	•	
101	Fx+0.30"Fz - Ορθογωνική	35	66	101	0	7	7	0	0	0	*	
109	-Fx+0.30*Fz - Ορθογωνική	18	48	66	0	4	4	0	2	2	•	
117	Fz+0.30*Fx - Ορθογωνική	35	45	80	0	5	5	0	6	6	-	
125	-Fz+0.30"Fx - Ορθογωνική	25	62	87	25	52	77	0	3	3		
											•	
											*	
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Env	λογή Ανάλυσης για Ελεγγο Ενια	τχύα	וששנ	1	• `		-					
	-14	are:	30033		1		Г	-	or	2	Cana	-1

This table gives you, each inelastic analysis performed, the total number of insufficient beams and columns for each performance level.

In the above example for all inelastic analyses, elements (D: Beams, K: Columns, S: Total) have failed in all distributions and combinations for the first performance level (DL), for some combinations in the second (SD) and even less in the third (NC).

In the "Print" column you select which inelastic analysis(s) to include in the study booklet.

By selecting a line with the mouse and pressing the "Preview Controls" button, the results for the specific analysis are displayed in detail:

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	E	AEFXOL	ETIAPH	EIAZ Ø	OPEA SI	EOPOYI	TAPAN	NOP#OSED	H	
-				0	61	4	्स	3#(T) (#/9#CZ)		Ta (sec)
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gan (too	sie Bladder	0.00	CIII.	1.28	1.17	1.24	10	6 1	66	0.3
Senill K	anhopt um	(F-NC)		1.28	5.17	1.41	10	6 Y	06	63
				Minacorty Minacorty Official	44 114	Encolecie Manakin da devices	-	Adyag Andrider	875A	PHEM
lipopm	uching Milds	ht; (A-DL)	5.5		141		8.24	0.00	1	Vier -
ligam tek	NO TANKING ST	18-50	61		1.11		9.34	0.40	1	Nes -
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++	3.30	1.00	16.0	8.50	6.81	764	34.00	1	242	Mai
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1-	1.00	10.00	1.00	1.17	203		-	1.10		
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			VELXOE	ЕЛАРКЕ	AT TEM	NOTED				
0 1	1+2.35	RZ-JAMAN	PR0117	191	WE LAC	RANGIE	1.0-804	NU MAR	18(2435)	1(71)
R. Koye	loc .	M(853	Veture	10	Vet	254	144105	A.OL	8-50	TAC
11	121	6.68	209.06	1/8/76	95-02	14	1.2948	030	11181	0.64
		Vid.s-	152,68	10.564	1.15	1.1	12.21	14.5	1.1	1.1.1
18	8.0	0.08	389.86	17.66	95.22	11.	12365	0.0	11011	CIMI
		Vid.a-	102.98							
2.1	- X	0.68	185.30	111.10	10.84	1/15	1.1288	MARE	1448	1016
		Writi,a+	112.88	-						
5 49	18	0.08	185.90	12,67	83.14	1/15	1.114	84/4	16/6	MN
		Wr0,e-	152.60			102.57		500		100
38	y.	0.08	175.55	595.3.3	80.36	1/10	1.00%	(car)	0.81	-0083
		Std.s-	152.98	Sec. 1	3.55.2	20110	2.5425	1.93	122,872	10015
310	12	83.0	(226.64	123.52	126.08	1/15	1.0201	NAME .	364	April
		Wyl,s -	256.67							
		2 9 50 11 354 2 655 11 410 4 651 15 631 16 3.02 17 420 18 3.02 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.03 14 3.04 14 3.04 15 1 16 4.03 17 2 18 4.14 19 1 2 1	2 9 30 9 30 10 3 54 2 60 11 3 54 2 60 11 4 30 5 30 11 4 30 5 30 15 5 31 5 60 15 5 31 5 60 15 5 31 5 60 14 3 39 7 10 17 4 22 3 60 14 3 30 100 14 3 30 100 14 3 30 100 14 3 30 100 14 3 30 100 14 3 30 100 14 3 30 100 14 3 30 100 14 3 30 100 14 130 100 14 130 100 14 130 100 14 130 100 14 13 100 15 1 100 <tr< td=""><td>2 3 50 3 200 He 16 3 54 3 30 5 30 5 30 17 3 54 3 30 5 30 5 30 14 4 33 3 30 5 30 5 30 15 5 33 3 40 5 30 5 30 16 3 37 3 40 5 30 7 30 17 3 23 3 40 5 30 7 30 18 3 47 3 30 7 30 7 30 14 3 30 19 30 5 30 7 30 14 3 30 19 30 5 30 7 30 17 4 53 3 30 7 30 7 30 18 4 53 3 30 7 30 7 30 14 135 3 30 7 30 7 30 14 135 3 30 7 30 1 40 14 135 3 30 7 30 1 40 14 135 3 30 7 30 1 40 14 <</td><td>2 3.50 3.00 He 6.69 16 3.54 8.80 5.92</td><td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td><td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td><td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td><td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td><td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td></tr<>	2 3 50 3 200 He 16 3 54 3 30 5 30 5 30 17 3 54 3 30 5 30 5 30 14 4 33 3 30 5 30 5 30 15 5 33 3 40 5 30 5 30 16 3 37 3 40 5 30 7 30 17 3 23 3 40 5 30 7 30 18 3 47 3 30 7 30 7 30 14 3 30 19 30 5 30 7 30 14 3 30 19 30 5 30 7 30 17 4 53 3 30 7 30 7 30 18 4 53 3 30 7 30 7 30 14 135 3 30 7 30 7 30 14 135 3 30 7 30 1 40 14 135 3 30 7 30 1 40 14 135 3 30 7 30 1 40 14 <	2 3.50 3.00 He 6.69 16 3.54 8.80 5.92	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $

OBSERVATION:

• The printout of the section adequacy checks in terms of deformation now shows in detail the quantities (Ci and the rest) used for the calculation of the targeted displacement and the check at the level of the girder:

ΕΛΕΓΧΟΣ ΕΠΑ	ΡΚΕΙΑΣ	ΦΟΡΕΑ	ΣΕ ΟΡΟΥ	Σ ΠΑΡ	PAMO	ΟΡΦΩΣΕΩΝ	I
	C0	C0 C1		C3	}	Se(T) (m/sec2)	Te (sec)
Περιορισμένες Βλάβες (A-DL)	1.20	1.1	7 1.00		1.00	7.0	6 0.33
Σημαντικές Βλάβες (B-SD)	1.20	1.1	7 1.24		1.00	7.0	6 0.33
Οιονεί Κατάρρευση (Γ-ΝC)	1.20	1.1	7 1.41		1.00	7.0	6 0.33
	Στοχευ Μετακ dt(c	όμενη ινήση :m)	Συνολι Μετακιν dm(cr	κή ήση n)		λόγος λ=dt/dm	ΕΠΑΡΚΕΙΑ
Περιορισμένες Βλάβες (A-DL)		2.69		8.24		0.33	Ναι
Σημαντικ Gontrol βας oper atos level		3.33		8.24		0.40	Ναι
Οιονεί Κατάρρευση (Γ-ΝC)		3.78		8.24		0.46	Ναι

This check is for the whole vector and compares the movement dm which is the movement corresponding to the last step of the pushover



With the targeted movements corresponding to the performance levels.

	Στοχευόμενη Μετακινήση dt(cm)	Συνολική Μετακινήση dm(cm)	λόγος λ=dt/dm	ΕΠΑΡΚΕΙΑ
Περιορισμένες Βλάβες (A-DL)	2.69	8.24	0.33	Ναι
Σημαντικές Βλάβες (B-SD)	3.33	8.24	0.40	Ναι
Οιονεί Κατάρρευση (Γ-ΝC)	3.78	8.24	0.46	Ναι

In this example the value is dm=8.24 cm. This is the maximum displacement the carrier can withstand before it collapses. This is compared to the target displacement of each performance level dt and must of course be larger, i.e. the demand (target) must be less than the "strength".

			E/	ΛΕΓΧΟΣ Ε	NAPKEI	Σ ΤΕΜΙ	ΝΟΥΣΩΙ	N			
ΣΤΥΛΟΙ	Fx+0	.30)*Fz - Τριγων	/ική (1)	BHN	1A: [A-D	L=15:1/1	5 B-SD="	15:1/15 F	-NC=15:1	/15]
Μέλος	Κόμβος		VR,SLS	Vrd,max	Vr	Ved	Βήμα	Λόγος	A-DL	B-SD	Γ-NC
1	1	z	0.00	399.86	79.76	96.03	1/4	1.2040	OXI	OXI	OXI
			Vrd,s =	152.68							
1	9	z	0.00	399.86	77.66	96.03	1/4	1.2365	OXI	OXI	OXI
			Vrd,s =	152.68							
2	2	у	0.00	185.30	74.10	83.14	1/15	1.1220	NAI	NAI	NAI
			Vrd,s =	152.68							
2	10	у	0.00	185.30	72.67	83.14	1/15	1.1440	NAI	NAI	NAI
			Vrd,s =	152.68							
3	3	у	0.00	175.55	89.53	90.38	1/10	1.0096	OXI	OXI	OXI
			Vrd,s =	152.68							
8	8	z	0.00	1228.84	123.52	126.00	1/15	1.0201	NAI	NAI	NAI
			Vrd,s =	254.47							
8	16	z	0.00	1228.84	119.34	126.00	1/15	1.0558	NAI	NAI	NAI

OBSERVATION:

At the bottom of the file, the Sectional Adequacy Check is also displayed only for shear-failing elements.

 addition, SCADA Pro incorporates the new check of the KANEPE, included in the latest revision of the KAN.EPE (2^h Revision 2017) and concerns the possibility of slippage due to shear at the base or other accidental cross-sections

wall.

The check is for pushover only and has been incorporated into the printout of the pushover checks in the corresponding section for intersections:

				LILLINOL	LIMINEI	AC ILIN	J 1 23614				
Δc	κοί	(Fx+0.30*	Fz – Τριγ	γωνική) (1)	BHMA :	[A-DL=	35 B-SD=	36 F-1	NC=36]
١M	Ιέλος	Κόμβ.	Vrd,s V	/rd,max	Vr	Ved	Βήμα	λόγος	A-DL	B-SD	T-NC
	37 37 44 44 51 51	2 y: 5 y: 8 y: 11 y: 14 y: 17 y:	565.49 565.49 565.49 565.49 565.49 565.49 565.49	328.34 328.34 328.34 328.34 328.34 328.34 328.34	209.51 209.51 211.26 211.26 211.26 211.26 211.26	226.79 232.08 226.02 232.85 226.56 232.31	1 1 1 1 1	1.0825 1.1077 1.0699 1.1022 1.0725 1.0997	OXI OXI OXI OXI OXI OXI	OXI OXI OXI OXI OXI OXI	OXI OXI OXI OXI OXI OXI
Στ	ύλοι	(Fx+0.30	*Fz - Τρι	ιγωνική)	(1)	BHMA :	[A-DL	=35 B-SD	=36 T	-NC=3	6]
IN I	Ιέλος	Κόμβ.	VR,SLS [V	/rd,max	Vr	Ved	Βήμα	λόγος	A-DL	B-SD	T-NC
 	4	31 y: 4 y: 	5.41 Vr 5.41 Vr	10.41 cd,s = 10.41 cd,s =	30.92 97.36 30.92 97.36	6.29 6.29		1.1612	OXI OXI 	OXI OXI 	OXI 0XI 0XI

ΕΛΕΓΧΟΣ ΕΠΑΡΚΕΙΑΣ ΤΕΜΝΟΥΣΩΝ

The value is **the slip resistance cutting torque VR,SLS** and the corresponding paragraph of the UNECE is Annex 7C. Two methods are provided for its calculation. The second one, the alternative (equation C.14), has been incorporated in the program.

OBSERVATION:

Two points are highlighted:

- A prerequisite for calculation of this strength and for performance of the test respectively, is that a bending failure has occurred, i.e. a plastic joint has been created in the limb under test.
- The second condition for performing the check is that the shear failure of the flexure has not preceded the bending failure (i.e. the end must not have a "square" lit). If the shear failure has preceded the bending failure, the test is not performed at all.

So when you do not see a value in the corresponding field, it means that the above conditions do not apply.

OBSERVATION:

At the end of this file and if you have selected to include the wall infills in the scenario parameters, the results of the adequacy check in terms of deformations for each wall infill are displayed. No results are shown for the tension bars because they are not taken into account in the construction model.

	ΕΛΕΓΧΟΣ ΕΠΑΡΚΕΙΑΣ ΤΟΙΧΟΠΛΗΡΩΣΕΩΝ ΣΕ ΟΡΟΥΣ ΠΑΡΑΜΟΡΦΩΣΕΩΝ									
		Περιορ	ισμένες Βλ (A - DL)	ιάβες	Σημαν	ντικές Βλό (B - SD)	ιβες	Οιον	εί Κατάρρ (Γ - NC)	ευση
Μέλος		γsd*εf	εγ	Επαρκεί	γsd*εf	εu/γrd	Επαρκεί	γsd*εf	εu	Επαρκεί
47	Εφελκ									
48	Θλιβ.	0.00271	0.00150	ΰχι	0.00271	0.00308	Ναι	0.00271	0.00400	Ναι
49	Θλιβ.	0.00374	0.00150	ΰχι	0.00374	0.00308	ΰχι	0.00374	0.00400	Ναι
50	Εφελκ									
51	Εφελκ									
52	Θλιβ.	0.00067	0.00150	Ναι	0.00067	0.00308	Ναι	0.00067	0.00400	Ναι
53	Θλιβ.	0.00332	0.00150	ΰχι	0.00332	0.00308	ΰχι	0.00332	0.00400	Ναι
54	Εφελκ									
55	Εφελκ									
56	Εφελκ									
57	Θλιβ.	0.00154	0.00150	ΰχι	0.00154	0.00308	Ναι	0.00154	0.00400	Ναι
58	Εφελκ									
59	Εφελκ									
60	Θλιβ.	0.00090	0.00150	Ναι	0.00090	0.00308	Ναι	0.00090	0.00400	Ναι
63	Θλιβ.	0.00329	0.00150	ΰχι	0.00329	0.00308	ΰχι	0.00329	0.00400	Ναι
64	Εφελκ									

In addition to the above printout, a file named "TOIXPL_DAT.txt" is created in the analysis scenario folder, which contains the data of the types wall fillings used and then the data of the wall fillings per facet. The general folder for the analysis scripts is the subfolder named "scaanal" within your study folder and the script is identified by its serial number.

I		ΤΥΠΟΙ ΤΟΙΧΟΠΛΗΡΩΣΕΩΝ
Ονομα Είδος Κομίσμα	:	Μπατική οπτοπλινθοδομή Υφιστάμενη ΣΑΔ: Ικανοποιητική ΣΠΕ: 1 γm=2.00 Γσιμομτοκομίσμα—ΜΕ (fm(MPa)=5.000)
Αρμοί	:	Πάχος(cm)=50.00 fk(Mpa)=3.44790 E(GPa)=3.45 Κατακόρυφοι πλήρεις: ΟΧΙ Οριζόντιοι πάχους > 15mm: ΟΧΙ

ΔΕΔΟΜΕΝΑ ΤΟΙΧΟΠΛΗΡΩΣΕΩΝ

Μέλος : Τοιχοποιία : Γεωμετρία(cm): Οπλισμένη : Ανοίγματα : Στάθμη Βλαβών : Λυγηρότητα : Αρμοί : Παραμορφώσεις : Θλιπτική αντοχή	94 Κόμβος Αρχής:24 Κόμβος Τέλους:30 L(cm)=688.77 Μπατική οπτοπλινθοδομή Παχος t=50.00 Μήκος l=620.00 Ψφος h=300.00 Πλάτος h=0.00 Αοπλη fwc,k(MPa)=3.45 E(GPa)=3.45 Χωρίς ή 1 μικρφ περίπου στο κέντρο (n1=1.00) Χωρίς βλάβες (FR=1.00 rk=1.00) Περιμετρική Επαφή (n3=1.00[1.00,1.00]) Κατακόρυφοι Αρμοί πλήρεις : NAI (n4=0.75) Οριζόντιος Αρμός πάχους > 15mm : ΟΧΙ (n5=1.00) εy=0.0006250 εu=0.0025000 ε´u=0.0037500 h fwc,s(MPa)=0.517 Μέτρο Ελαστικότητας : E'(GPa)=2.607
Μέλος : Τοιχοποιία : Γεωμετρία(cm): Οπλισμένη : Ανοίγματα : Στάθμη Βλαβών: Αυγηρότητα : Αρμοί : Παραμορφώσεις : Θλιπτική αντοχή	95 Κόμβος Αρχής:26 Κόμβος Τέλους:28 L(cm)=688.77 Μπατική οπτοπλινθοδομή Παχος t=50.00 Μήκος l=620.00 Ψωος h=300.00 Πλάτος h=0.00 Αοπλη fwc,k(MPa)=3.45 E(GPa)=3.45 Χωρίς ή 1 μικρό περίπου στο κέντρο (n1=1.00) Χωρίς βλάβες (rR=1.00 rk=1.00) Περιμετρική Επαφή (n3=1.00[1.00,1.00]) Κατακόρυφοι Αρμοί πλήρεις : NAI (n4=0.75) Οριζόντιος Αρμός πάχους > 15mm : ΟΧΙ (n5=1.00) εγ=0.0006250 ευ=0.0025000 ε'υ=0.0037500 η fwc,s(MPa)=0.517 Μέτρο Ελαστικότητας : E'(GPa)=2.607
Μέλος : Τοιχοποιία : Γεωμετρία(cm): Οπλισμένη : Ανοίγματα : Στάθμη Βλαβών: Αυγηρότητα :	96 Κόμβος Αρχής:25 Κόμβος Τέλους:30 $L(cm)=724.98$ Μπατική οπτοπλινθοδομή Παχος t=50.00 Μήκος l=660.00 Ύφος h=300.00 Πλάτος h=0.00 Αοπλη fwc,k(MPa)=3.45 $E(GPa)=3.45$ Χωρίς ή l μικρό περίπου στο κέντρο (n1=1.00) Χωρίς βλάβες (rR=1.00 rk=1.00) Περιμετρική Επαφή (n3=1.00[1.00,1.00])

📃 Εκτύπωση συγκεντρωτικού πίνακα στο τεύχος

when checked includes in the study booklet

the printing of this summary table.

OBSERVATION:

Finally, the option

It should be noted that the results of this table are **ONLY** an **INDICATION**. It is at the designer's discretion what the final choice will be, defined by selecting from the list the <u>type of distribution</u> which the control and <u>sizing of the reinforcements will be carried out:</u>



analyses for the chosen EIS.

3(α).9 **Results - Active stiffnesses**

We select the command "TXT file Intensive", then the option of key ΤΧΤ Αρχείο Εντατικών

and the following file appears, containing the lists with :

- Displacements and Junction Rotations for all junctions per direction
- Intensive Member sizes at the beginning and end of each member
- Active stiffnesses for each Pillar and each Beam

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e Edit Vie	ew insert	Format Help	1.					
		3200						
		HETATO	DITEIT / D	EFITTPOOET	HOMBEN			
	eu.	HETAT	OTIT	1 2 1	T E P	IXTPO	+ E I	
ioµβ,[Φορ	st.i 58	(mm) 8	y (nm)	8z (mm)	Ox(rad)	0y(rad)	Or(red)	
	1	1		1	1		-1	-
11	1 0.00	GE+000[+1.3	52E+000} 0	-000E+0001	9.45E-0051	0.00E+000	01-7.07E-00	5
21	1 0.00	OE+000 -1.5	84E+0001 0	.000E+0001	4.18E-005)	0.00E+000	4.068-00	5
31	1 0.00	OE+000[-1,7	€7£+0001 0	.000\$+000]	5.53E-0051	0.00E+000	01-1.198-00	4
41	1 0.00	0E+000 -1.5	05E+0001 0	-000E+0001	2.37E-0051	0,002+000) -6,86E-00	5
51	1 0.00	OE+0001-1.6	38E+0001.0	.000E+0001	1,11E-004{	0.002+000	01-2.71E-00	5
61	1 0.00	OE+0001-2.2	57E+0001 0	.000E+0001	3.85E-005)	0.00E+000	01 6.51E-00	5
-71	1 0.00	GE+0001-2.4	962+0001 0	-000E+0001	1.19E-0071	0.002+000	01-9.21E-00	5
01	1 0.00	OE+0001-2;1	232+0001 0	.0002+0001	4.01E-0051	0.008+000	01-9.768-00	5
21	1 2,99	OE-001(-1.3	96E+0001 1	.0992-001	-7.295-0051	0.00E+000	0-1.34E-00	9
101	1 3,17	SE-0011-1.6	17E+0005 1	.410E-001	6.64E-0051	0,00E+000	01 1.66E-00	5
11	3.01	3E+001 +1.8	26E+000) 1	.410E-001	2.61E-005;	0.00E+000	0 1.94E-00	4
121	1 2.98	9E-0011-2.0	148+0001 1	.262E-001)	-3.55E-0041	0.00E+000	01-2.14E-00	4
231	1 3.37	3E-001 -1.7	342+0001 1	-2692-0011	2.51K-004(0.00#+000	01 1.048-00	4
141	1 3.20	05-0011-2.4	162+0001 1	.269E-001	3.118-0041	0.002+000	01 2-04E-00	4
15)	1 3.20	OE+0011-2.5	41E+0001 1	.046E-001(3.43E-0051	0.00E+000	01-1.40E-00	-
16)	1 3.37	3E-001(-2.1	58E+0001 1	.046E-001	9.63E-0051	0.00E+000	01-1.38E-00	4
171	1 6.11	8E+001 -1.4	15E+0001 1	.293E-0011	-9.65E-0051	0.00E+000	01-1.358-00	4
244	1 6.85	OE-0011-1.0	378+0001 2	-503E-0011	6.78E-0051	0,002+000	01 2.178-00	4
191	1 6,20	5E-001[-1,6	428+0001 2	.504E-001	2.25E-0055	0,002+000	01 6.54E-00	5
201	1 6.11	4E-001(-2.0	47E+0001 1	.9282-001	2.39E-005(0,00E+000	01-8.17E-00	5
21	1 7.61	GE-001 -1.7	83E+000 1	.956E-001)	4.08E-004)	0.00E+000	01 2.83E-00	4
221	6.93	6E-001(-2.4	71E+0001 1	.956Z-001	-1.52E-0045	0.00E+000	01 2.67E-00	5
231	1 6,93	48-0011-2.5	568+0001 1	.005E-0011	-3.19E-0051	0.00E+000	01-1,202-00	4
241	1 7,61	0E-0011-2,1	742+0001 1	.085E-001	1.16E-0040	0.002+000	01-1.50E-00	4
251	1 3.16	6E-001 0.0	00E+0001 1	.202E-0011	0.00E+0001	-3.61E-006	6 0.00E+00	0
261	1 6.84	7E+0011 0.0	00E+0001 1	.682E+0011	0.00E+0001	-1.41E-005	51 0.00E+00	0
			ENTATIKA M	ETEGH MEAG	a.			
		2.52			19 N. N		1.1	
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ριθμίλρι Έλ. (Φορ	θμ[Κομβ. στ.[Α./Τ.	1 N (801)	QY (RN)	QZ (X31)	MX (R004)	NX (K30H) 1	M2 (RNM)	
рівційр: Iel. Imor	θμ[Κομβ. στ.[Α./Τ.	N (RN)	QY (891)	QZ (939)	HX (R0H)	MY (KIN)	M2 (RNM)	÷
ριθμίλρι (ελ. [Φορ 	θμ[Kouβ. στ.[λ./Τ. 	N(RN) 	QY(RN) 7.15	22 (KN)] 21.20	HX (ROB) 	-50,801	M2 (RNM)	÷.
ριθμ]Άρι (ελ. [Φορ 	θμ[Κομβ. οτ.ΙΑ./Τ. Ι Ι Ι 9	1 321.37 1 -267.70	QY(RN) T.15 -7.15	QZ (R3) 	MX (R081) 	-40.801 -10.07	-24.96 42.11	-
ριθμίλρι (ελ. (Φορ 	θμ(Χομβ. στ.(Α./Τ. 5 2	N (RN) 	QY(RN) 	QZ (RN) 21.201 -21.201 -16.271	HX (R00) 	-50.801 -10.071 33.431	H2 (RNH) -24.96 42.11 26.10	÷.
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φιθμίλοι (ελ. (Φορ 1) 1) 2) 3)	θμ(Κομβ. οτ.ΙΑ./Τ. Ι 1 Ι 9 Ι 2 Ι 10 Ι 3	N(RN) 	27(RN) 7.15) -7.15 21.26 -21.26 19.20	22 (89) 21.20) -21.20) -16.27 16.27 9.87	90. (1001) 	HY (KIN) -50.801 -10.071 33.431 5.621 -24.071	H2 (RNH) -24.96 42.11 26.10 24.93 13.01	-
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For Help, press F1

3(a).10 Seismic Action

Finally, with the inelastic scenario always active and by selecting the Seismic Action command, the data for the spectra, the level of performance and the extent of the damage are displayed and then, for each analysis, the maximum base shear, the corresponding maximum displacement and the overstrength ratio, the minimum overstrength ratios per direction:

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Στάθμες Επιτελεστικότητας - Ελαστικά Φάσματα									
Ζωή σχεδιασμού (έτη)	50		Εκθέτ		3.00		00		
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	TR(έτη)		TLR(έτη)	PR(έτη)	PLR	:((έτη)	ag		
Περιορισμένες Βλάβες (A-DL)	475		475	10	1	10	0.24000		
Σημαντικές Βλάβες (B-SD)	475		475	10	1	10	0.24000		
Οιονεί Κατάρρευση (Γ-ΝC)	475		475	10	10		0.24000		
Στάθμη Αξιοπιστίας Δεδομένων :	Ικανοποιητ	τική			yg=		1.35		
Εκταση Βλαβών :	Χωρίς Βλάβες & Χωρίς Επεμβάσει		τεις γsd=		1.00				
Κόμβος Ελέγχου :	26		6.00m						
Α/Α Ανάλυση Είδος Ανάλυσης - Ι	Είδος Ανάλυσης - Κατανομής			Μέγιστη Μετακίνηση (m)		Λόγος Υπεραντοχής			
1 Τριγωνική Fx+0.30*F	Τριγωνική Fx+0.30*Fz			0.082		11.528			
Ελάχιστος Λόγος Υπεραντοχής Χ					(1)		11.528		
Ελάχιστος Λόγος Υπεραντοχής Ζ									
J. Showing Proficiency Ratios with Color Grading

In the new version of SCADA Pro has been added to the Analysis the color gradation for the adequacy reasons concerning the valuation according to KAAN.EPE. Pressing right click on the desktop displays the following menu.

	Εμφάνιση όλων	
1	Απόκρυψη Απομόνωση	
11 + XIII C T	Αντηγραφή Μεταφορά Διαγγαφή Πώνακας (Απεγ) Περιστροφή Offset	
単名	Δημιουργία κλώνου Μεταφορά ομάδας	
· · ·	Αριθμήσεις Εμφάνιση Χρυμιτικών Διαβαθμοιών Απόκρυψη Χρυμιτικών Διαβαθμότων Τhe Duckover scenario, both	and selecting Show Color Gradients depending on the analysis scenario that is active

For the pushover scenario both beams and columns, two values are calculated for the capacity ratios at the beginning and at the end of member:

- Sufficiency ratios in terms of Pushover (2 values, start end)
- Reasons for adequacy in terms of Pushover
- Data behaviour

A prerequisite for the above reasons to appear is that you have gone through Controls Preview located by pressing



So, having the inelastic analysis scenario active, in the known dialogue box by selecting

Εμφανιση μεγεθών με χρωματική διαβάθμιση 🛛 🗙							
∆окоі ∨ + ∨ Y ∨							
Λόγοι επάρκειας σε όρους Παραμορφώσεων (Pusho 🗸							
Fx+0.30*Fz - Τριγωνική 🗸 🗸 - 🗸							
Εύρος τιμών							
🗹 Εμφάνιση μόνο αυτών που αστοχούν (λόγος > 1)							
Από 0 Εως 0							
🗹 Εμφάνιση Τιμών							
OK Cancel							

you get the following vector image:



For more details about the colour gradations in the Anelastic analysis you can consult the User's Guide "8A.Analysis" (p.40).

4(a) STEP 4: ENCOUNTERS

4 (a).1 General

A member is considered necessary to be strengthened when it cannot carry its vertical loads and the loads resulting from the design earthquake. The need to strengthen specific structural elements of the design is determined on the basis of options :

- The level of performance
- The type of distribution to be used for the control and sizing of aids

So, having selected performance level B and distribution type Orthogonal (for this example), you refer to "Report":



You return to the "Sizing" section where:

by using the "Reinforcement Details" commands for columns and beams, you have the possibility to apply the materials and technologies of interventions and reinforcements according to the basic principles of these methods officially defined by the provisions of the Interventions Regulation.

NOTE: The basic requirement for the sizing of the reinforcements is the selection and calculation of the combinations of the inelastic saved in a respective step of the procedure and the creation of a Eurocode (EC2) sizing scenario, as well as the selection of the desired Performance Level within the window of each reinforcement, between A, B and C.

Tankers	Les Impôrezon gov Technique Uni	niav Itoqo mu; damot	iny Indus II	etera Deriva	οί κοντικές Κλιβον Ιδηνίκ Ιλίου	X Auto Detailing A Auto * Hannal * 2 Factors + Denail	nende Aurris und Départ ne liége	Australia Degen Subpension,* 10 - 100 mark * Supreman,* 10
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4 (a).2 Aid

ScadaPro has integrated the tools for the rehabilitation and strengthening needs of the columns and walls, as well as the beams, as required by the intervention regulation (KAN.EPE)



and all the controls and procedures required for them.

A detailed description of each aid is given in the corresponding chapter of the User Manual entitled CHAPTER A: 'DOKA INVESTMENTS' & CHAPTER B: 'DETAILS OF COLUMN REINFORCEMENTS

As for the reinforced columns, for the beams that have been reinforced, it is highlighted on the screen:

In addition, depending on the type of aid, the corresponding indicative letter appears:

- Cloak: "M"
- Lamma (Lama) : "L"
- ♦ IOP: "I"



A prerequisite for the display of the highlighting is that you have selected the Τεύχος button in the window of the respective aid

OBSERVATION:

It should be noted that after the introduction of reinforcements, new M-N interaction diagrams should always be calculated,

- or through the Armament Details for each cross-section separately,
- or via for all poles/row and all levels
 Enovounoλογισμός μεγεθών ΚΑΝ.ΕΠΕ. for all structural elements of the user
- either with the via either withe via either with the via either with the via either with the

3(b) STEP 3: ELASTIC ANALYSIS

3(b).1 General

In the case of Elastic, you create a new elastic static or dynamic analysis scenario.

Scenario				Х
Επαναρίθμηση Κόμβων Cuthill-McKee(II)	~	Advanced Multi-Thre	l aded Solver	
Ακύρωση	Ονομα			
EC-8_Greek Ελαστική Static (0) EC-8_Greek Ελαστική Dynamic	Ανάλυση	EC-8_Gr	eek	\sim
	Τύπος − Ιδιότητες	Ελαστική	Dynamic	~
	Μέλι	1	Κόμβοι	
	Φορτία	εις	Μάζες	
	Nέo		Ενημέρωση	
	Εκτέλεσ	η ολων τα	ων αναλύσεων	/
		Εξοδο	ιç	

You then follow the procedure for running the script. In the "Parameters" dialog box:

Παράμετροι EC8		×
Σεισμική Περιοχή Σεισμικές Περιοχές Ζώνη Ι ν a 0.16 *g a (KAN.EΠΕ.) 0.16 *g Σπουδαιότητα Ζώνη ΙΙ ν V ⁱ 1	Χαρακτηριστικές Περίοδοι Τύπος Φάσματος Οριζόντιο Κατακόρ. Τύπος 1 S,avg 1.2 0.9 Εδαφος TB(S) 0.15 0.05 Β TC(S) 0.5 1.1 TD(S) 2.5 1	Επίπεδα ΧΖ εφαρμογής της σεισμικής δύναμης Κάτω 0 - 0.00 Ανω 2 - 600.00 Δυναμική Ανάλυση Ιδιοτιμές 10 Ακρίβεια 0.001 CQC Συντελεστές Συμμετοχής Φάσματος Απόκρισης PFx 0 PFy 0 PFz 0
Φάσμα Φάσμα Απόκρισης Σχεδιασμ ζ(%) 5 Οριζ Φάσμα Απόκρισης Ενη Είδος Κατασκευής q Σκυρόδεμα ν qx Τύπος Κατασκεύης Χ Σύστημα Πλαισίων	ού ∨ Κλάση Πλασπμότητος DCM ∨ όνπο b0 2.5 Κατακόρυφο b0 3 μέρωση Φάσματος Sd(T) >= 0.2 a*g ✓ 2.3 qy ✓ 2.3 qz ✓ 2.3 Z Σύστημα Πλαισίων	Εκκεντρότητες Sd (T) e τιχ 0.05 *Lx e τιz 0.05 *Lz d (TY) 1 sd (TY) 1 sd (TY) 1 sd (TY) 1 sd (TZ) 1 Avoiyματα Εσοχές χ Χωρίς εσοχές ζ Χωρίς εσοχές
Ιδιοπερίοδοι Κτιρίου Μέθοδος Υπολογισμού Ιδιομορφική Ανάλυση Οριο Σχετικής Μετακίνησης ορό Είδος Κατανομής Τριγωνι	X Δύσκαμπ ζ Δύσκαμπ φου 0.005 Χαρακτηρισμός Σεισμοπλήκτων κή ~	τα χωρικά πλαίσια από Σκυρόδεμα τα χωρικά πλαίσια από Σκυρόδεμα Τοιχεία ΚΑΝΕΠΕ Default OK Cancel ΚΡΙΤΗΡΙΑ ΑΠΑΛΛΑΓΗΣ ΕΛΕΓΧΟΥ ΣΤΑΤΙΚΗΣ ΕΠΑΡΚΕΙΑΣ

set the parameters as you would for an EC8 scenario.

By pressing the "CANOPE" button the following dialog box appears

Παράμετροι Ελαστ	κής	×		
🗹 Υπολογισμός στα	ιθερής τιμής μήκους διά	τμησης LS		
Στάθμη Αξιοπιστίας Δεδομένων				
Γεωμετρίας	Ικανοποιητική	~		
Υλικού	Ικανοποιητική	\sim		
Λεπτομερειών	Ικανοποιητική	\sim		
Εκταση Βλαβών για τον υπολογισμό του γSd (Σ.4.2)				
Εντονες & Εκτεταμένες Βλάβες-Επεμβάσεις 🛛 🗸 🗸				
Συντελεστής επαύξησης γSd				
Μέθοδος Υπολογια	τμού - Ανάλυσης / Επιτ	ελεστικότητα		
Τοπικός Δείκτης π	λαστιμότητας(m) - Γ(ΝΟ	c) ~		
Enaύξηση (m),(q) §5.7.2 (β)				
Τιμές του δείκτη συμπεριφοράς q'				
Εφαρμοσθείς καν	Εφαρμοσθείς κανονισμός το ή μετά το 1995 🛛 🗸			
Ευμενής παρουσία ή απουσία τοιχοπληρώσεων 🗸 🗸				
Υπάρχουν ουσιώδ	Υπάρχουν ουσιώδεις βλάβες σε πρωτεύοντα στοιχεί \vee			
ОК	ΦΑΣΜΑΤΑ	Cancel		

• In the "Calculate constant LS shear length value" option you specify:

- if the shear length of the elements will be calculated with a fixed value based on the length

as provided for by the CANEP* (ticked)

- or whether it will be calculated on the basis of the resulting intensive magnitudes, where Shear Length
- = M/V at the end section of the element, i.e. the distance of the end section from the zero point of the moments.

As far as shear length is concerned, the method of calculation is important, both for the classification of the elements into **plastic** and **sandy** and for the method of calculation of local plasticity indices where the calculation of θ y and θ u is required.

3^h revision of the EIA:

- The gg depends on the geometry and
- The cRd from the worst SDS between material and details.

So in the four scenarios of the CANPE of the elastic analysis, in the context of a dialogue that is displayed with the CANOPE button, all three SIDs are now displayed

Υπολογισμός στ	αθερής τιμής μήκους διάτ	μησης LS
Στάθμη Αξιοπιστί	ος Δεδομένων	
Γεωμετρίας	Ικανοποιητική	~
Υλικού	Ικανοποιητική	~
Λεπτομερειών	Ικανοποιητική	~

• Select:

For each Data Reliability Level

Ικανοποιητική	
Ανεκτή	
Υψηλή	
τψηλη	

• Extent of Damage

The ysd factor is automatically calculated based on the corresponding option,

Εντόνες & Εκτεταμένες Βλάβες-Επεμβάσεις
Ελαφρές & Τοπικές Βλάβες-Επεμβάσεις
Χωρίς Βλάβες & Χωρίς Επεμβάσεις

		Συντελεστής επούξησης γSd	0
•	The value 0 in the field		

means that the coefficient will take the value based on *table .4.2.* of the EIA.

If you want your own value, enter a number and it will be <u>added up</u> to the value provided by the table. Calculations are made based on the resulting sum.

Where more precise data are not available, cSd values according to the following Table may be used.

Έντονες και	Ελαφρές και	Χωρίς βλάβες και
εκτεταμένες βλάβες	τοπικές βλάβες	χωρίς επεμβάσεις
ή / και επεμβάσεις	ή / και επεμβάσεις	
$\gamma_{Sd} = 1,20$	$\gamma_{Sd} = 1,10$	$\gamma_{Sd} = 1,00$

Πίνακας Σ 4.2: Τιμές του συντελεστή γsd

Βλ. και Παράρτημα 7
Δ και Παράρτημα ΣΤ περί βλαβών και φθορών.

IMPORTANT OBSERVATION:

The csd coefficient is automatically calculated based on the corresponding option, but since the CANEPE allows the elastic analysis to be selected regardless of the criteria AND ONLY FOR ASSESSMENT, provided that the csd is increased by 0.15, there is a field "Increment coefficient", where you can enter the value you wish.

• Method of Calculation - Analysis / Performance

The next field concerns the choice of the type of elastic analysis (global index behaviour (**q**) or local ductility indices (**m**)) for each level of performance.

• For performance level A, the m method is not applicable.

Καθολικός Δείκτης συμήξριφοράς(q) - A (DL)
Καθολικός Δείκτης συμπεριφοράς(q) - B (SD)
Καθολικός Δείκτης συμπεριφοράς(q) - Γ (NC)
Τοπικός Δείκτης πλαστιμότητας(m) - B (SD)
Τοπικός Δείκτης πλαστιμότητας(m) - Γ(NC)

- The choice of method (m) assumes an elastic response spectrum, whereas the method (q) assumes a design spectrum with modified seismic coefficient behavior (q).
- The following fields relate to parameters for method q.

Τιμές του δείκτη συμπεριφοράς q'	
Εφαρμοσθείς κανονισμός μετά 1995	\sim
Ευμενής παρουσία ή απουσία τοιχοπληρώσεων	\sim
Υπάρχουν ουσιώδεις βλάβες σε πρωτεύοντα στοιχε	\sim

• The following figure of the parameters is shown when the method of the global index of behaviour (**q**) for performance level B is selected.

Φάσμα Φάσμα Απόκρισης Σχεδιασμού 🔻 Κλάση Πλαστιμότητος DCM 💌
ζ 5 Οριζόντιο b0 2.5 Κατακόρυφο b0 3
Φάσμα Απόκρισης Ενημέρωση Φάσματος Sd(T) >= 0.2 ag
Είδος Κατασκευής
Σκυρόδεμα 🔻 qx 🗸 3 qy 🗸 3 qz 🗸 3
Τύπος Κατασκεύης
Χ Σύστημα Πλαισίων Ζ Σύστημα Πλαισίων

Then, select the command FRAME

The EIR provides a minimum tolerable target based on the building's significance category based on the table below:

Πίνακας ΠΑ.2.1. Ελάχιστοι ανεκτοί στόχοι αποτίμησης ή ανασχεδιασμού υφισταμένων κτιρίων.

Κατηγορία Σπουδαιότητας	Ελάχιστοι Ανεκτοί Στόχοι
Ι	Г2
П	Г1
III	B1
IV	B1 και A2 (Ικανοποίηση και των δύο στόχων)

Σε κάθε περίπτωση να θεωρηθεί ότι ισχύει A1>A2, B1>B2, Γ1>Γ2, A1>B1>Γ1 και A2>B2>Γ2

3^h revision of the 2022 EIA.

In the new EIA, more seismic hazard categories are introduced (9 in total from 2 before), the term *seismic class* is introduced, as well as a new method of assessment and redesign (which can be followed as an alternative to the one in force until now).

Seismic class is the maximum rating or redesign target for a given level of performance. It is derived from the combination of performance level and αg rate.

The seismic classes for performance level B are considered as basic seismic classes.

Πίνακας Σ 2.1	Ενδεικτική συσχέτιση περιόδου επαναφοράς και πιθανότητας υπέρβασης της σεισμικής δράσης με				
	EILA.	αντίστοιχη	aval/lingsal	οριζόντια	εδαφική
	SHIN	agoroup.			

Περίοδος Επαναφοράς (έτη)	Πιθανότητα υπέρβασης σεισμικής δράσης εντός του συμβατικού χρόνου ζωής του 50 ετών	ag lag,ref
2475	2%	1.80
975	5%	1.30
475	10%	1.00
225	20%a	0.75
135	30%	0.60
70	50%	0.45
40	70%	0.35
20	90%	0.25
<20	>90%	<0.25

Στον Πίνακα 2.1 παρουσιάζεται, η συσχέτιση της στάθμης επιτελεστικότητας του φέροντος οργανισμού με την αντίστοιχη ανηγμένη οριζοντια εδαφική επιτάχυνση. Στον Πίνακα Σ 2.1 παρουσιάζεται, μια ενδεικτική συσχέτιση της περιόδου επαναφοράς και της αντίστοιχης πίθανότητας υπέρβασης ευτός του συμβατικού χρόνου ζοής του 50 ετών της οεισμικής δράσης με την αντίστοιχη ανηγμένη οριζόντια εδαφική επιτάχονση. Πίνακας 2.1. Στόχοι αποτίμησης ή ανοσχεδιασμού Φέραντος Οργανισμού.

	Στάθμη Επιτελεστικότητας Φέροντος Οργανισμού					
$a_{\rm g}/a_{\rm g,ref}$	Α «Περιορισμένες Βλάβες»	Β «Σημαντικές Βλάβες»	Γ «Οτοντί Κατόρρευση»			
1.80	A0	BO	FO			
1,30	AP	B1*	IN THE			
1.00		BI	- FI			
0.75	- A2	1127	125			
0.60	A2	812	12			
0.45	A3*	B3*	13			
0.35	A3	B3	13			
0.25	Λ4*	B4	14			
<0.25	A4	B4	14			

 α_{g.ref} είναι η οριζοντια εδαφική επιτάχυνση αναφοράς, που ορίζεται με πιθανότητα υπέρβασης της σεισμικής δράσης 10% στα 50 χρόνια συμβατικής ζωής του έργου.

αg είναι η οριζόντα εδαφική επιτάχονση.

δ. Σεισμική κλάση κτιρίου ορίζεται ως ο μέγιστος στόχος αποτίμησης ή ανασχεδιασμού που μπορεί να εξασφαλίσει ένα κτίριο για μια επιλεγείσα στάθμη επιτελεστικότητας. Η σεισμική κλάση κτιρίου για στάθμη επιτελεστικότητας Β («Σημαντικές Βλάβες») θεωρείται βασική σεισμική κλάση.

Based on the above table we can summarize that my level of performance determines m, q (elastic) and θ u (inelastic) and my return period and exceedance probability determines the seismic acceleration α g.

The three valuation targets (or the three seismic classes) for a 10% earthquake are still called A1, B1, C1 and have a factor of one but the targets for a 50% earthquake are now called A3+, B3+, C3+ and have a factor of 0.45 (from 0.53 previously). Still the two basic seismic hazard categories are no longer 10% and 50% but 10% with a factor of 1 and 30% with a factor of 0.60 (the two lines in bold in the table).

In the parameters of the 5 scenarios related to EIS there is now a new field for the ground acceleration that will be calculated and used based on the above table.

Going to the framework

We select the seismic hazard category with the corresponding triad of seismic classes and the factor by which the initial reference ground acceleration will be multiplied in order to obtain the ground acceleration of the CANEPE

λάσματα		×
Στόχοι αποτίμησης ή ανασχεδιασμού Φέροντος Οργανισμού	A1 B1 F1 1.00	-
7	A0 B0 Γ0 1.80 A1+B1+Γ1+ 1.30	
Ζωη σχεοιασμού (επη) 50 ~	A1 B1 F1 1.00 A2+B2+F2+ 0.75	
Εδεγχος Εδαφική επιτάχυνση ag=AgR.γΙ.(1	A2 B2 F2 0.60 FFA3+B3+F3+ 0.45	
Υπολογισμός ΤΡ.Υπολογισμός Τ	ГL АЗ ВЗ ГЗ 0.35 А4+ В4+ Г4+ 0.25	
Περίοδος επαναφοράς TR (ἐτη) 475 Πιθανότητα υπ	4 В4 Г4 <0.25	

or the default 10% or 30% which automatically sets the Ta

Ρόσματα	×	Φόσματα
Στάχοι αποτίμησης ή ανασχεδιασμού θέροντος Οργανισμού	1.00 v	Στόχοι αποτίμησης ή ανασχοδιασμού Φέραντος Οργανισμού 🗛 Β2 Γ2 0.60 🤟
Zuń αχοδοσμής (έτη) 50 γ Βιθέτης k (3.0)	3	Zuch dysőkosuci (Em) 50 - 12 Stelleny; k (3.0) 3
Eloperi unitari (n. 167) Eloperi unitari unitari (n. 167) Eloperi unitari unitari (n. 167) Yoshovati (n. 18	0.24	Tepelphonese product (M - Cec) Elseywate: egr-AgR-yL (TR/TLR)1A 0.144 Tepelphonese TR Tepelphonese TR Tepelphonese TR
Περίοδος εταναφοράς ΤΕ (έτη) 475 Πθοινότητα υτέρβοσης ΡΕΡ%	10	Περίοδος επαναφοράς Τ.Κ. (έτη) 135 Πιθονάτητα υπέρβοσης Ρ.Ε.Κ.% 10
Πιθανάτητα υπέρβασης PR % 10 Περίοδος επαναφοράς TUR (έτη)	475	Πθανάτητα υπέρβασης PR16 30 Παρίοδος επονοφοράς TUR (έτη) 475
Σημαντικός Βλάβες (Β - 50) Εξουρική επτάχονση 2g=λgR, γL.(TR/TLR) 1,6 Υπολογκαμός TR Υπολογκαμός TLR	0.24	ຽງພວການປະ Bldglac (B - 50) [2] EXeryanc Eδαφική επιτόχυνση ag=AgR.vt.(TR/TLR)1/k 0.144 Υπολογισμός TR.
Περίοδος επαναφορός Τ.R. (έτη) 475 Πιθανότητα υπέρβασης PLR.% Πιθανότητα υπέρβασης PR.% 20 Πιρίοδος επαναφοράς Τ.R. (έτη)	10	Περίοδος επαναφοράς ΤΚ (έτη) 135 Πιθανότητα υπέρβασης ΡLR% 10 Πιθανότητα υπέρβασης PR% 30 Περίοδος επαναφοράς TLR (έτη) 475
Οσυνεί Κατάρρευση (Γ - Ν.C) Εξεργχος Εξοσική επιτόχονση ag=AgR.v/L.(TR/TLR) 1/k Ταολαγκρός TR Υπολογκρός TLR	0.24	Οιανεί Κατάρρεωση (Γ-ΝC) Ελεγχος Εδαρική επτάχωνση εg=AgR.γE.(TR/TLR)1/k 0.144 Υπολογομός TR Υπολογομός TLR
Περίοδος επαναφορός Τ.R. (έπι) 475 Πεθονότητα υπέρβασης PLR%	10	Περίοδος επαναφορός ΤR (έπ) 125 Πιθανότητα υπίρβασης PLR % 10
Πιθανότητα υπέρβασης PR % 20 Περίοδος επαναφοράς TLR (έτη)	475	Πθανότητα υπέρβασης PR% 30 Περίοδος επαναραράς TLR (έτη) 475
RANETE 10% KANETE 30% ED:0% ED:0% ED:0%	3 20%	Tipoca/oyi) KAMETE 30% KAMET KAMET CK Cancel

and returning to the initial parameters of the scenario in the field of ground acceleration CAN.EPE.

Δεισμική Περιοχή

	Σεισμικές Περιοχές					
z	ώνη	Π	\sim	а	0.24	*g
	a (K	AN.E	ΠE.))	0.144	*g

we see the value of the ground acceleration as it was calculated previously and as it will be used in the execution of the scenario for the calculation of the seismic action.

It is also noted that the yi used for the calculation of the seismic action always becomes 1 (from 0.8 which was before for the specific importance category) based on the following paragraph of the CANEPE.

Σπουδαιότητα						
Ζώνη	I	\sim	γi	1		

Για πιθανότητα υπερβάσεως 10% εντός του συμβατικού χρόνου των 50 ετών λαμβάνεται υπόψη η σεισμική δράση του ΕΚ 8-1, ενώ για διαφορετική πιθανότητα υπερβάσεως εντός του συμβατικού χρόνου των 50 ετών λαμβάνεται υπόψη το ποσοστό της παραπάνω σεισμικής δράσεως του ΕΚ 8-1, σύμφωνα με τα διαλαμβανόμενα στην § 2.2. θεωρώντας αντίστοιχα σε όλες τις περιπτώσεις τον συντελεστή σπουδαιότητας γ_Γίσο με τη μονάδα.

(3^η Αναθεώρηση 2022)

The script is now ready to run without even needing a spectrum update.

K. Explanatory Example:

Suppose we are in zone II (α =0.24). We set the other parameters and select Update Spectrum to update the spectrum.

Then select the command . KANETE

• <u>Method m (</u> only for performance levels B & C)

We select from the drop-down menu the m calculation method and the corresponding S.E.

Παράμετροι Ελαστικής	Х			
🗹 Υπολογισμός σταθερής τιμής μήκους διάτμησης LS				
Στάθμη Αξιοπιστίας Δεδομένων				
Εκταση Βλαβών για τον υπολογισμό του γSd (Σ.4.2)				
Εντονες & Εκτεταμένες Βλάβες-Επεμβάσεις	-			
Συντελεστής επούξησης γSd 0]			
Μέθοδος Υπολογισμού - Ανάλυσης / Επιτελεστικότητα				
Τοπικός Δείκτης πλαστιμότητας(m) - B (SD) 🛛 🗸				
Καθολικός Δείκτης συμπεριφοράς(q) - Α (DL) Καθολικός Δείκτης συμπεριφοράς(q) - Β (SD) Καθολικός Δείκτης συμπεριφοράς(q) - Γ (NC)				
Τοπικός Δείκτης πλαστιμότητας(m) - Β (SD)	6			
Τοπικός Δείκτης πλαστιμότητας(m) - Γ(NC) Εφαρμοσθεις κανονισμος μετα 1995				
Ευμενής παρουσία ή απουσία τοιχοπληρώσεων	1			
Υπάρχουν ουσιώδεις βλάβες σε πρωτεύοντα στοιχεί 🛇				
OK ØAΣMATA Cancel				

Going to the framework

We select the seismic hazard category with the corresponding triad of seismic classes and the factor by which the initial reference ground acceleration will be multiplied in order to obtain the ground acceleration of the CANEPE $\lambda \dot{\alpha}$

Στόχοι αποτίμησης ή ανασχεδιασμού Φέροντος Οργανισμού	A1	B1	Γ1	1.00	\sim
	A0	B0	Г0	1.80	
7ωή αγεδιασμού (έτπ) 50 🗸	-A1+	-B1+	· F1+	1.30	
	⁴ 1	B1	Γ1	1.00	
Περιορισμένες Βλάβες (Α - DL)	A2+	- B2+	· Г2+	0.75	
	A2	B2	Γ2	0.60	
Ελεγχος Εδαφική επιτάχυνση ag=AgR.γΙ.(1	IR A3+	- B3+	· F3+	0.45	
Υπολογισμός TR Υπολογισμός Τ	L A3	B3	Г3	0.35	
	, A4+	- B4+	· F4+	0.25	
Περίοδος επαναφοράς TR (έτη) 475 Πιθανότητα υπ	έf Α4	B4	Γ4	<0.25	

and returning to the initial parameters of the scenario in the field of ground acceleration CAN.EPE.

Σεισμικές Περιοχές									
Zώνη II 🗸 a	0.24	*g							
a (KAN.ERE.)	0.144	*g							

• <u>Method q (for performance levels A & B & C)</u>

The final value to be used in the spectral acceleration is ag/q*. q* is the coefficient of Table 4.1 times q' .

<u>Πίνακας 4.1</u> : Τιμές του λόγου q*/q' αναλόγως του στόχου επανελέγχου (για τον φέροντα οργανισμό)

Στάθμη επιτελεστικότητας							
«Περιορισμένες βλάβες» (A)	«Σημαντικές βλάβες» (B)	«Οιονεί κατάρρευση» (Γ)					
0,6 πάντως δε 1,0 <q*<1,5< td=""><td>1,0</td><td>1,4</td></q*<1,5<>	1,0	1,4					

q' is obtained from Table 4.4 :

Πίνακας Σ 4.4: Τιμές του δείκτη συμπεριφοράς η΄ για την στάθμη επιτελεστικότητας Β («Σημαντικές βλάβες»)

Εφαρμοσθέντες Κανονισμοί μελέτης (και	Ευμενής παρο απουσία τοιχοπληρώσε	υσία ή α ων (1)	Δυσμενής (γενικώς) παρουσία τοιχοπληρώσεων (1)			
κατασκευής)	Ουσιώδεις βλά πρωτεύοντα σ	ίβες σε τοιχεία	Ουσιώδεις βλάβες σε πρωτεύοντα στοιχεία			
	Όχι	Ναι	Όχι	Ναι		
1995 <mark>≤</mark>	3,0	2,3	2,3	1,7		
1985 <mark>≤</mark> <1995(2)	2,3	1,7	1,7	1,3		
<1985	1,7	1,3	1,3	1,1		

This gives q*.

Note here that the user does not need to calculate anything. The program does this on its own when we select CANPE, e.g.

Παράμετροι Ελαστικ	ής		×	and the	n set
🗹 Υπολογισμός σταθ	ερής τιμής μήκους	διάτμησης LS		returns t We cond	he val
Στάθμη Αξιοπιστίας Δεδομένων	Ικανοποιητική	~		spectral	accele
Εκταση Βλαβών για	τον υπολογισμό το	ου γSd (Σ.4.2)			
Εντονες & Εκτεταμ	ένες Βλάβες-Επεμβ	βάσεις	~		
Συντελεστής επούξ	ησης γSd	0			
- Μέθοδος Υπολογισμ Καθολικός Δείκτης	ιού - Ανάλυσης / Ε συμπεριφοράς(α) -	Επιτελεστικότητα			
Καθολικός Δείκτης Καθολικός Δείκτης	συμπεριφοράς(q) - συμπεριφοράς(q) -	A (DL) B (SD)			
Τοπικός Δείκτης Τοπικός Δείκτης πλ Τοπικός Δείκτης πλ Έφαρμοσθεις κανοι	οσπμότητας(m) - Β αστιμότητας(m) - Β αστιμότητας(m) - Γ νισμος μετα 1995	(SD) (NC)			
Ευμενής παρουσία	ή απουσία τοιχοπλι	ηρώσεων	~		
Υπάρχουν ουσιώδε	ς βλάβες σε πρωτε	ύοντα στοιχεί	~		
the context of dialo	gue	select	the tri	ad A2, B2,	C2, C2
ОК	ΦΑΣΜΑΤΑ	Cancel			
	ΦΑΣΜΑ	ТА			

and then set the elastic parameters. Then the program returns the value of q*.

We conclude that the program automatically divides the spectral acceleration by q*.

and hor en			
Στάχοι αποτίμησης ή σνοσχεδι	οαμού Φέρι	ovroç Opyovojaŭ A2 82 F2 0	.60 V
Ζωή σχεδιασμού (έτη) 50	- 41	ExBitmy; k (3.0)	3
Παρκορισμένες Βλάβες (Α - DL)			
Ελεγχος Εδος	ροκή επιτόχ	uvon ag=AgR.yL(TR/TLR)1/k	0.216
Υπολογισμός ΤΠ	100	Υπολογισμός ΤLR	
Περίοδος εποναφορός TR. (έπς)	135	Πιθανάτητα υπέρβασης PLR%	30
Πθανότητα υπέρβοσης ΡΠ%	30	Περίοδος επονοφαρός ΤLR (έτη)	475
Injuovnesis; 6Ad(Res; (6 - SD)			
Ελεγχος Εδα	ρκή επήδη	uvon ag=AgR.yI.(TR/TLR)1/k	0.216
Υπολογισμός ΤΡ.		Υπολαγισμός ΤΕR	
Περίοδος επανοφοράς TR. (έτη)	135	Πθανότητο υπέρβασης PLR %	10
Νθανότητα υπέρβασης PR%	30	Περίοδος επονοφορός ΤLR (έπη)	475
Ovoval Kambposuon (F - NC)			
Ελεγχος Εδοι Υπολογισμός ΤΒ	text caugh	υνση ag=AgR.yl.(TR/TLR)1/k Υπολογισμός TLR	0.216
Περίοδος επαναφοράς Τ. (έπι)	135	Πιθανότητο υπέρβοσης PLR%	10
Πιθανότητα υπέρβασης PR %	30	Περίοδος επονοφαρός TLR (έτη)	475
Προεπλογή			
	5e ====	CROWN ROR INC.	20%

The program calculated the new acceleration 0.36*0.60= 0.216 and in the return period and in the probability of exceedance it wrote the data of the specific seismic hazard category. In this example it is 30% and 135 years. And returning to the initial parameters of the scenario in the field of the ground acceleration CAN.EPE.



I see the value of the ground acceleration 0.216 as it was calculated previously and as it will be used in the scenario run to calculate the seismic action.

It is also noted that the γ i used for the calculation of the seismic action always becomes 1 (from 0.8 which was before for this importance category).



So after the above parameters are selected, run the script. The "Default" combinations are automatically created and saved. You will use this file for sizing the reinforcements.

Selecting "**Checks**" again displays all the checks, including the analysis selection criteria, but what is of interest is only the following deficiency indicator check.

Κρί	σιμοι Δείκ	τες Αν	επάρκ	ειας λ δ	χείων			(8	\$ 5.5.20	x (i) KAN	I.ENE)		
											Σελ	ίδα : 2	
α/α		Δo	кої			Υποστυλώματα			Σύν	Σύνολο			
Στάθμη ς	Υψός (m)	λ<=	1.0	λ>1	1.0	λ<=	1.0	<u>λ></u>	1.0	λ<=	1.0	λ>1	1.0
0	0.000	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
1	3.000	6	30%	4	20%	8	50%	0	0%	14	39%	4	11%
2	6.000	10	50%	0	0%	2	13%	6	38%	12	33%	6	17%
ΣΥΝΟ	16	80%	4	20%	10	63%	6	38%	26	72%	10	28%	
ΣΗΜΕΙΩΣ	ΣΗΜΕΙΩΣ Για όλα τα στοιχεία πρέπει λ<=1.0.							Ο έλεγχος : Δεν		εν Ικαν	Ικανοποιείτ.		

This table summarises the elements that fail and need to be strengthened.

The above check of the indicators of inadequacy is done in terms of intensive quantities (bending moments).

The program calculates the bending indices λ for all structural elements (flat and flattened). At the same time, however, the categorisation of the elements into flat and loose elements is done.

Based on the CEE, 3 criteria of fishiness are applied and if even one of the 3 is valid, the element is defined as fishy and the corresponding inadequacy index λ is calculated based on the shear forces.

This calculation is done regardless of whether the method of analysis is (m) or (q).

A detailed presentation of the elements that fail and the analytical results of the sandy elements and the flat elements are presented in the section of the prints.

L. Show adequacy reasons with Color Grading

	😕 In t	the new v	ersion o	of SCAD	A Pro has been	added to the A	nalysis the colo	r gradatio	n for the adequa	асу
rea	sons con	cerning t	he valua	ation ac	cording to KAA	N.EPE.				
Pre	ssing	right	click	on	surface	desktop	appears	the	the following	menu.
Q	Εμφάνιση	όλων								
Ŷ١	Απόκρυψη	1								
2	Απομόνως	τη								
\$\$	Αντιγραφή	i								
+	Μεταφορά	t								
×	Διαγραφή									
***	Πίνακας (Α	rray)								
Ċ	Περιστροφ	ρή								
t	Offset									
8	Δημιουργί	α κλώνου								
86	Μεταφορά	ι ομάδας								
4	Αριθμήσει	ç								
 (•)	Εμφάνιση	Χρωματικών	Διαβαθμίσ	των						
۲	Απόκρυψη	γ Χρωματικών	ν Διαβαθμί	σεων	and by selecti	ng Show Color G	Gradients depen	ding on th	e analysis scena	ario that is

active the corresponding sizes are displayed

With the Elastic Dynamic scenario active, let's say you want to display for the columns the inadequacy indices λ (Shear) for **Ved/Vrd** ratio **z**.

Δείκτες ανεπάρκειας λ (Διάτμηση) 🛛 🗸 🗸	
✓ A - ✓	
Εύρος τιμών	
🗹 Εμφάνιση μόνο αυτών που αστοχούν (λόγος > 1)	
Από 0 Εως 0	
🗹 Εμφάνιση Τιμών	
OK Cancel	
	you have the following vector image :



For more details about the colour gradations in Elastic analysis you can consult the "8A.Analysis" User Manual (p. 39).

4(b) STEP 4: ENCOUNTERS

With regard to the introduction and sizing of reinforcements, the same applies as in the section on inelastic analysis, with attention to the following points:

The basic requirement for sizing reinforcements by elastic analysis is the selection and calculation of the combinations stored in the previous step.

With regard to the sheathing of columns necessary condition for the execution of checks is in the field of stations performativity, is to click on the option with asterisks.

Ελεγχοι		
	Στάθμη επιτελεστικότητας	A - DL 🔻
Επιλογή πλευράς	Μήκος Συναομογής (cm)	A - DL
V		B - SD
τηολογισμος Συνολικα		F-NC
	μηχανισμού τριρης(%)	×*****

Regarding the choice of asterisks in the editors of dikes and poles regarding the intensive sizes for the reinforcement check: the option reads with first priority the intensities of the last scenario where the checks appeared in the analysis and with second priority the intensities of the combinations you loaded in the dimensioning.

A similar choice shall be made for the IOP-Fragments of the columns

Στάθμη επιτελεστικότητας	A - DL 🔻
Μήκος Συναρμογής (cm) Ποσοστό Εντασης μέσω	A - DL B - SD F - NC
μηχανισμού τριβής(%)	******

And in the beams you make the same selection, in the beams editor

Γεωμετρία	Κύριος Οπλισμός Ανοίγι	ματος	Οπλισμός Στηρ	ξεων	Συνδετήρες	Προσθετα	P
Αριθμός Αγ	οίνματος 1	Υλικ	ò				
– Esviká m			Σκυρόδεμα :	C20/25			
Túnoc	Οιχαία Πρόσθετες Στρώσεις (Μ	Χάλυβας (Κύριος) :Β500C					
Evia	α ενίσχυση σε όλο το μή	v	Χάλυβας (Συνδ/ρων) :B500C				
Επικάλυψ	η Πάχος Γ	Προσπεί	λασιμότητα	Βλ	ήτρα - Αναρτή	ρες :S400	
(mm) 20	15 📝 Ταυ Μειο	(Πιν ωμένη	·.Σ4.2) ▼	Στάθμ επιτε/	ιη \εστικότητας	*****	•

After inserting the reinforcements and calculating the new strength moments * you return to the Analysis section, run the elastic analysis scenario and see again the λ ratios of the elements.

OBSERVATION:

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* It should be noted that after the introduction of reinforcements, new M-N interaction diagrams should always be calculated,

- or through the Armament Details for each cross-section separately,
 - or via
- either with the via Επαναυπολογισμός μεγεθών ΚΑΝ.ΕΠΕ.
 for all structural elements of the vector and all levels.

* In addition, there is also the possibility of total deletion of the reinforcements of beams and columns.

Scenario	×
1	Ονομα Τύπος ΕΚΩΣ 2000-ΕΑΚ Νέο Ενημέρωση Διαγραφή Διαστασιολόγησης Σκυρόδεμα Συνδέσεις Σιδηρά Εφαρμογή Συνολικός Οπλισμός Κπρίου Αποθήκευση Εισαγωγή
	Συνολική Διαγραφή Ενισχύσεων Δοκών Στύλων

5. NEW METHOD OF EVALUATION AND REDISTRIBUTION (CAN.EPE. 3. Review 2022)

The new method of valuation and redesign that can be followed as an alternative to the one analysed above and applicable until now. This method applies only to buildings of importance I and II and only for the basic seismic class B.

So for buildings of importance I and II it follows:

1. wastheuntil now with table PA2.1, that is, whatever class your building belongs to, you must meet the minimum requirements of the table.

Κατηγορία Σπουδσιότητας	Ελάχιστοι Ανεκτοί Στόχοι
I	Γ2
п	Γ1
Ш	BI
IV	B1 και A2 (Ικανοποίηση και των δύο στόχων)

Πίνακας ΠΑ.2.1. Ελάχιστοι ανεκτοί στόχοι αποτίμησης ή ανασχεδιασμού υφισταμένων κτιρίων.

Σε κάθε περίπτωση να θεωρηθεί ότι ισχύει Α1>Α2, Β1>Β2, Γ1>Γ2, Α1>Β1>Γ1 και Α2>Β2>Γ2

2. The new possibility provided by the PA2.2 table where, after determining the basic seismic class to which your building belongs, it is enough to go up one basic seismic class. seismic class, but this class shall be higher or at least equal to the minimum of table PA2.2.

Πίνακας ΠΑ.2.2. Ελάγιστες βασικές σεισμικές κλάσεις υφισταμένων κτιρίων σπουδαιότητας Ι και Π.

Εφαρμοσθέντες Κανονισμοί Μελέτης και Κατασκευής	Ελάχιστη Βασική Σεισμική Κλάση Κτιρίου
<1985	B3
1985≤<1995	B3 ⁺
1995≤	B2 ⁺

The above will be understood with an example

EXAMPLE

Building after 1995 Significance II

- 1. I do not specify its seismic class (I am not interested) and I am pursuing the minimum evaluation or redesign target C1 (as it was until now)
- 2. I identify the existing basic seismic class which is, for example, B2. I need to move up at least one class, i.e. to B2+ and I need to

this must be higher than the minimum of table PA2.2, which for our example is B2+ but improved by one class, i.e. B1. So the target is B1.

	Στάθμη Επιτελε	στικότητας Φέροντο	ς Οργανισμού
$\alpha_g / \alpha_{g,ref}$	Α «Περιορισμένες Βλάβες»	Β «Σημαντικές Βλάβες»	Γ «Οιονεί Κατάρρευση»
1.80	A0	B 0	ГО
1.30	A1 ⁺	B1 ⁺	Γ1+
1.00	A1	B1	Γ1
0.75	A2 ⁺	B2 ⁺	Γ2 ⁺
0.60	A2	B2	Г2
0.45	A3 ⁺	B3+	Γ3+
0.35	A3	B3	Г3
0.25	A4 ⁺	B4 ⁺	Γ4 ⁺
< 0.25	A4	B4	Γ4

Πίνακας 2.1. Στόχοι αποτίμησης ή ανασχεδιασμού Φέροντος Οργανισμού.

Comparing the two cases and assuming approximately that B and C classes diagonally are approximately the same, C1 corresponds approximately to B2+. So the second method will give me less favourable results than the first. In general, the second, new method favours older and weaker buildings while the existing method favours newer ones. In the programme, at present, the determination of the seismic class can only be done by testing, i.e. by testing evaluation targets from the basic seismic class (B). That target where for elastic analyses λ is below unity and for pushover the tests for the B performance level are below unity is the existing basic seismic class of the building. For this determination, however, we are preparing an automatic procedure where the program will automatically perform all the analyses and checks and will present the results in summary so that the designer can immediately find the seismic class of his building.

6. Printed from

In the prints section and in the analysis scenarios field, the scenarios you have created are presented.

NOTE: It is a prerequisite for the print files to be created that the controls are opened in the analysis. Any change, afterwards, in the parameters of the scenario requires the controls to be reopened in the analysis in order to update the prints each time.

Διαθέσιμα Κεφάλαια	Τεύχος Μελέτης	Πλήθος Σελίδων :		
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EC-8_Greek Προέλεγχος Dynamic	Sc3 Δείκτες Ανεπάρκειας	şλ	Μετακίν	νηση Πάνω
⊕ Στατική	Sc3 Ελεγχος επιρροής α	νώτερων ιδιομορφών		
	Sc4 Δείκτες Ανεπάρκειας	5 A	METOKIV	ηση κατω
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Αποτελέσματα Προελένχου	Sc5 Ελεγχος Επαρκειας (σε όρους Παραμορφ	1000 (MAR)	
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<u>⊕</u> ∙ Δυναμική				
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- Σεισμική Δράση			Διαμόρφα	ωση Σελίδαα
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