

ETABS v22.1.0 Release Notes

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Notice Date: 11-July-2024

This document lists changes made to ETABS since v22.0.0, released 31-May-2024. Items marked with an asterisk (*) in the first column are more significant.

Design – Concrete Frame

Enhancements Implemented

*	Ticket	Description
	10637	An enhancement has been made to ACI concrete codes "ACI 318-14" and "ACI 318-19" for torsion design if redistribution of torsion and forces are identified. The members for which redistribution is identified are designed for a torsion maximum of T_u and $\phi * T_{cr}$ per section ACI 318-14 22.7.3 and ACI 318-19 22.7.3. The members for which redistribution is not identified are designed for a torsion T_u obtained from analysis. If a member is overwritten with a reduction factor for torsional stiffness or if the member is assigned a section for which a reduction factor for torsional stiffness is applied, it is considered to redistribute torsion.

Design – Steel Frame

Enhancements Implemented

*	Ticket	Description
	10634	An enhancement has been made to the steel frame design code AISC 360-22 in which the expression for the C_b factor for singly symmetric I-shapes has been modified to include the effect of singly symmetric I-shape parameter, R_m , per AISC commentary equation C-F1-3. The manual has been updated accordingly. In addition, the manual has been updated to include the effect of axial tension on C_b per AISC section H1.2, where C_b is amplified by a factor $\sqrt{1+\alpha*P_r/P_{ey}}$. The program was correct regarding the latter effect.

Graphics

Enhancements Implemented

*	Ticket	Description
	2267	An incident was resolved where tabulated values for joint reactions were not being displayed in the GUI for restrained joints that are internally created because of auto meshing. Joint reactions as arrows were being shown for internal joints as expected.

Installation and Licensing

Enhancements Implemented

*	Ticket	Description
	10619	The version number has been changed to v22.1.0 for a new intermediate release.

Structural Model
Enhancements Implemented

*	Ticket	Description
	2401	An enhancement was made to use Mander confined concrete curves based on transverse reinforcement data specified in the concrete frame section for program-generated Fiber hinges. The Mander confined concrete curve will be generated for fiber hinges assigned to frames which have a Concrete Rectangular or Concrete Circular type frame section and a Mander type concrete material, using the rebar and confinement information specified as part of the frame section properties. When viewing the generated fiber hinge, the Mander confined material name will indicate the frame section which it is associated with. This enhancement does not apply to section designer sections and does not use rebar and confinement data from Concrete Frame Design, but will be expanded to include these at a later time.
	10642	An enhancement has been implemented whereby two new wide flange sections, W14X930 and W14X1000 (metric designation W360X1384 and W360X1488), have been added to the ArcelorMittal_US_ASTM-A913, ArcelorMittal_US_ASTM-A913M, ArcelorMittal_US_ASTM-A992, and ArcelorMittal_US_ASTM-A992M frame section libraries.

Database Tables

Incidents Resolved

*	Ticket	Description
	10604	An incident was resolved where the database table for Frame Tension/Compression Limit assignment was not generated if a model only had one or more frames with both tension and compression limits assigned at the same time. There was no issue generating the table if the model had frames with only tension or compression limit assigned.
	10657	An incident was resolved where all selected objects would get deselected when menu for interactive editing was invoked. This prevented interactive editing of items for only the selected objects. This issue only affected v22.0.0.

Design – Composite Beam

Incidents Resolved

*	Ticket	Description
	10683	An incident affecting composite beam design overwrites was resolved. The items labeled b-eff left and b-eff right in the Composite Beam Overwrites form did not refer as expected to the left-side and right-side deck effective widths used to compute composite beam properties. Instead, they referred to half the distance to the nearest approximately parallel beam or to the distance to the nearest slab edge as may be the case on the left or right side of the beam (the "deck widths" for short). While deck widths place an upper limit on effective widths, effective widths are also limited by beam spans and their value may also take into account the beam flange widths and other code dependent items. The items labeled b-eff left and b-eff right in the Composite Beam Overwrites form now refer to the effective widths as expected, with the deck widths also displayed but not editable. This incident affected all versions of ETABS capable of designing composite beams. When a confusion occurred, the effective width used by ETABS was always smaller than the user-specified overwrite and its value was documented in the design output.

Design – Shear Wall

Incidents Resolved

*	Ticket	Description
*	10685	An incident was resolved for shear wall design where shear design and boundary element checks were using the forces for the entire pier instead of forces in a leg when multiple legs were present. This issue only occurred in v22.0.0 and previous versions were not affected.

Design – Steel Frame

Incidents Resolved

*	Ticket	Description
	10626	An incident has been resolved for the AISC ASD 89 steel frame design in which the lateral factor was always taken as 1.333 for design combos having seismic loads. It is now taken from the design preferences.
	10666	An incident has been resolved in Canadian steel frame design codes "CSA S16-14" and "CSA S16-19" in which the program made an error in calculating the effective area, Aeff, when the section is a Class 4 section in the axial compression mode for the web being slender ($h/t_w > 670/\sqrt{F_y}$). The reduction in area for the web is $b_{reduction} * t$, where t should be taken as t_w , while SAP2000 used $t=t_f$. Since t_f is typically greater than or equal to t_w , this correction will increase the value of Aeff slightly, and the program was conservative. This change affects the axial force capacity of slender I-shapes when the web is slender. All other sections remain unaffected.
	10705	An incident was resolved where program was crashing while changing the number of bolts in connection design overwrites.

**External Import and Export
Incidents Resolved**

*	Ticket	Description
	10655	An incident was resolved where importing a DXF file for architectural plan was causing an error condition for some models.
	10669	An incident was resolved where Summary Report was not working when User interface was in Chinese language. This issue was only present in v22.0.0.
	10682	An incident has been resolved for the exporting and importing model file with the Eurocode 2-2004 composite column design and the Eurocode 2-2004 and Italian NTC 2008 concrete frame designs. For the Eurocode 2-2004 composite column design, importing model text or .XLSX file shows error message for PLUGWELDED, WELDINGTYPE, and RHSSSTHICK design parameters while these are not available in the Preference form nor used in the design. For the Eurocode 2-2004 and Italian NTC 2008 concrete column designs, importing model .XLSX file shows error message for the Tan(Theta) value even though it is 1.0, which is within the allowed range of 0.4 and 1.0. Now, these error/warning messages are fixed.

**Graphics
Incidents Resolved**

*	Ticket	Description
	10679	An incident was resolved in DirectX graphics where viewing wall using color by "Section Properties" in the deformed shape and running animation was showing the wall using black color.

**User Interface
Incidents Resolved**

*	Ticket	Description
	10631	An incident was resolved where displaying the tendon "Vertical Profile Control Points" in the Display > Set View Options was causing an abnormal termination. This was an issue in v22.0.0 only.
	10643	An incident was resolved where the BU I Cover plate rendering for frame sections was not correctly displayed. No results were affected.
	10650	An incident was resolved where exporting tables to Excel in Chinese language was causing an abnormal termination. This issue only affects v22.0.0.
	10652	An incident was resolved where adding a support to a tendon was causing an error condition. This issue was only present in v22.0.0 and previous versions were not affected.
	10677	An incident was resolved where modifying grids using right mouse click > Modify/Show Grids > click on Reference Planes button and use Escape was causing an error condition.
	10678	An incident was resolved for DirectX graphics where drawing a new wall and using mouse wheel pan was not showing the section label in plan view if wall sections were displayed prior to wall drawing.
	10681	An incident was resolved where deleting all time history function or response spectrum function disabled time history/response spectrum function tool buttons.

ETABS v22.0.0 Release Notes

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Notice Date: 30-May-2024

This document lists changes made to ETABS since v21.2.0, released 30-November-2023. Items marked with an asterisk (*) in the first column are more significant.

API

Enhancements Implemented

*	Ticket	Description
	1263	The following functions have been added to the Application Programming Interface (API) for access to the design preferences and design overwrites of the AISC 360-10 and AISC 360-16 steel frame design codes: cSapModel.DesignSteel.AISC360_10.GetOverwrite, cSapModel.DesignSteel.AISC360_10.GetPreference, cSapModel.DesignSteel.AISC360_10.SetOverwrite, cSapModel.DesignSteel.AISC360_10.SetPreference; cSapModel.DesignSteel.AISC360_16.GetOverwrite, cSapModel.DesignSteel.AISC360_16.GetPreference, cSapModel.DesignSteel.AISC360_16.SetOverwrite, cSapModel.DesignSteel.AISC360_16.SetPreference
	10316	An enhancement has been made to add Application Programming Interface (API) functions DesignConcrete.SetComboStrength and DesignShearWall.SetComboStrength that specify load combinations for design of concrete frames and shear walls, respectively.
*	10489	Following enhancements have been made to the API: ETABS (ETABSv1.dll) and cross-product API (CSiAPIv1.dll) libraries have been updated to target .NET Standard 2.0, increasing range of compatibility to API clients targeting .NET Standard 2.0, .NET Framework 4.6.1 to 4.8.1 and .NET (Core) 2 to .NET 8. Increased support for complex plugins where dependencies of the plugin might conflict with dependencies of ETABS. Better error handling for API clients calling API functions that were not implemented by the connected version of ETABS. The Remote API feature, used to start and/or connect to a running instance of ETABS on a Remote Computer, has been disabled with the release of ETABS v22.0.0. This functionality may be added back to the program in a future release. Please see API help file for details regarding backward & forward compatibility.

Data Files

Enhancements Implemented

*	Ticket	Description
	10121	Three new frame section libraries have been added conforming to AISC Shapes Database v16.0. These libraries are consistent with the shape properties and dimensions tabulated in AISC Steel Construction Manual, 16th Edition, 1st Printing. The new shapes database files are (1) AISC16.xml - Shapes database in US customary units, (2) AISC16M.xml - Shapes database in metric units, and (3) AISC16-A1085.xml - This database contains dimensions and properties for HSS shapes covered under ASTM A1085/A1085M and is in US customary units.
	10364	A new library has been added for standard ASD load tables in XML format for Open Web Steel Joists (K-Series), Open Web Steel Joists (KCS), Long Span Steel Joists (LH-Series), and Deep Long Span Steel Joists (DLH-Series) per American National Standard SJI 100-2020.
	10441	A new material library has been added for United States materials per the ASTM A1085/1085M specifications.

Database Tables

Enhancements Implemented

*	Ticket	Description
	6284	An enhancement has been implemented to allow the addition and modification of section-cut definitions through Interactive Database Editing when the model is Locked or Unlocked. Previously, section-cut definition could only be edited interactively when the model was Unlocked.
	10289	An enhancement was made to display tabular results for the linear static load cases that are internally generated to represent the seismic eccentricity for response-spectrum load cases when using the Chinese license.
	10464	Two enhancements to composite beam design were implemented: (1.) The tables of composite beam overwrites now include the values automatically computed during design for composite deck width, direction, and id; vibration floor width and floor length; and free edge parameter when these values have been specified as program-determined. New columns have been added to the tables to indicate how the overwrites have been specified, i.e., program-determined or user-defined. (2.) The tables of composite beam design output now include the values of the beam tributary areas, left and right effective widths, detailed top flange lengths, and shear stud strengths (two values, if the number of studs per row is not constant).

Design – Composite Beam

Enhancements Implemented

*	Ticket	Description
*	8196	An enhancement has been made to add composite column design per the CSA S16-19 code.
*	10183	Composite beam design per AISC 360-22 has been added. It is essentially the same as composite beam design per AISC 360-16, with a slightly more permissive evaluation of the axial capacity of collector beams. Verification models and manuals adapted from the Companion to the AISC Steel Construction Manual Design Examples, Version 16.0 are provided.
*	10188	An enhancement has been made to add composite column design per the AISC 360-22 code.
	10279	An enhancement was made to composite beam design such that when an auto-select section that is assigned to some composite beams includes one or more sections with a material whose unit weight is zero, optimization of these beams will be based on section area even when the design preferences specify optimization based on cost (which is computed based on a cost per pound of steel). Previously the design would favor the largest section with zero weight, which could be over-conservative.
	10290	An enhancement to the composite beam design of cantilevers and their backspans was implemented. When designing interactively a backspan and checking its shear, moment, and deflection diagrams, a new checkbox labeled "Apply Load Pattern" lets the user view these diagrams in the case where there is no live load on the cantilever and there is a partial live load on the backspan (corresponding to a percentage of the design live load which can be specified in the Composite Beam Design Preferences form). Note that cantilever backspans have always been designed for the moments and deflections produced by such loading patterns, but that the new functionality lets the user visualize how the values are derived.
	10303	An enhancement has been made to speed up joist design by using parallel processing, similar to what has previously been done for steel frame, concrete frame, composite beam, concrete shear wall, concrete slab strip, and concrete slab FEM design. This feature can be controlled using the Analyze menu > Advanced Design and Response Recovery Options command for Number of Threads for Design.
	10306	An enhancement to steel joist design was implemented. The Interactive Steel Joist Design and Review form has been reorganized with new functionalities added, such as: (1.) changing the selected beam design by clicking on it in the form, (2.) reviewing all tentative designs, including the ones that fail, and (3.) switching between results for the originally selected beam or for the most critical beam in the group when the selected beam is part of a group selected for steel joist design.

* Ticket	Description
10372	An incident was resolved for composite beam design where attempts to design composite beams that were adjacent to a deck whose fill material was of a metal type would trigger a series of error messages, one per beam, which all had to be dismissed. Now such beams will be designed as non-composite. A related enhancement has been implemented where the choices of slab material and deck material in the Deck Property Data form are now restricted to concrete and steel materials, respectively.
10425	Steel joist design per the SJI 2010 code has been enhanced so that the design calculations can now be exported to reports and tables.
10433	An enhancement to the design of composite collector beams per the AISC 360-16 and 360-22 codes was implemented. When designing a composite collector beam and computing its unbraced length L_z for the limit-state of constrained-axis torsional buckling, ETABS now considers that the beams framing into it locally prevent its section from twisting. A related enhancement was implemented: The user can now overwrite the value of L_z computed by ETABS in the Composite Beam Overwrites form. Note that this enhancement is specific to design per the AISC 360-16 and 360-22 codes because composite collector beams can only be designed per these two codes.
10482	An enhancement has been made for the AISC 2010 and AISC 2016 composite column design codes where a new table showing shear design details has been added to the Envelope tab of the right-click design report.

Design – Concrete Frame Enhancements Implemented

* Ticket	Description
5389	An enhancement has been made to the concrete frame design code "ACI 318-19" where the design now considers the interaction of major- and minor-direction shear forces in a column per ACI 318-19 sections 22.5.1.10 and 22.5.1.11. It is noted that if any of $V_{u,x}/\phi * V_{n,x}$ or $V_{u,y}/\phi * V_{n,y}$ is less than 0.5, or if $V_{u,x}/\phi * V_{n,x} + V_{u,y}/\phi * V_{n,y}$ is less than 1.5, this enhancement has no effect per ACI 318-19 sections 22.5.1.10 and 22.5.1.11.
* 10025	An enhancement was made to add joint-shear design for ACI 318-19 concrete frame design. Joint shear is now performed for Ordinary moment frames (OMF) in Seismic Design Category (SDC) B, for Intermediate moment frames (IMF), and for Special moment frame (SMF). The joint shear force for OMF and IMF are computed using the nominal flexural strength of the beams. SMF joint shear is computed using the probable flexural strength of the beams.

Design – Shear Wall Enhancements Implemented

* Ticket	Description
* 5391	An enhancement has been made to the concrete shear-wall design code "ACI 318-19" where now the design amplifies the factored shear forces, V_u , in a Special Structural Wall to calculate the design shear force V_e ($V_e = \Omega_v * w_v * V_u < 3.0 * V_u$) per ACI 318-19 section 18.10.3.1. The documentation has been updated accordingly. This check for Special Structural Walls was not present in earlier versions.
10320	An enhancement was added for ACI 318-19 shear wall design output where h_w/L_w and α_c parameters are provided.

Design – Slab Enhancements Implemented

* Ticket	Description
10323	An enhancement was added for Chinese 2010 slab design code where the design preference item "Negative Moment Modifier" was renamed as "Gravity Negative Moment Reduction Factor". This reduction factor will now be applicable for gravity combinations only. When this factor is less than 1, negative moment will be reduced and positive moment will be amplified for any design combination that includes gravity loads only. Previously, this factor was applied to all load combinations and only used for reducing the negative design moment.

**Design – Steel Frame
Enhancements Implemented**

*	Ticket	Description
	1879	An enhancement was made for the AISC 360-16 steel frame design code where now the design preferences and overwrites “HSS Welding Type (ERW)” and “Reduce HSS Thickness?” (Preference items 28 and 29 and Overwrite items 41 and 42) have been removed. The AISC Section database for the 15th Edition already included the necessary reduction in tube/pipe thickness, making these items obsolete.
	9407	The following enhancements have been made to the steel frame design code NZS 3404:1997 based on the determination of whether a member or a segment of a member is fully lateral restrained or not. A member or segment is now considered to be fully laterally restrained if $M_{bx} = M_{sx}$ (NZS 5.3.2.2.1) for that member or segment, which implies that $\alpha_m * \alpha_s > 1$ according to NZS 5.6.1.1(1). (1.) For a member with axial compression and bending about the x-axis, the following moment ratio is checked per NZS 8.4.4.1.1 only when the member or segment does not have full lateral restraint: $M^*x / \phi * M_{ox}$. Here M^*x is the design moment, and M_{ox} is the nominal out-of-plane member moment capacity. Previously, the ratio was checked irrespective of whether the member or segment had full lateral restraint. (2.) When a member or segment is fully laterally restrained, and the PMM interaction for a compression member with biaxial bending is checked per NZS 8.4.5.1, then M_{cx} is set to M_{ix} instead of $\min(M_{ix}, M_{ox})$. For members that are not fully laterally restrained, M_{cx} is set to the minimum of M_{ix} and M_{ox} , as done previously. (3.) When a member or segment is fully laterally restrained, and the PMM interaction for a tensile member with biaxial bending is checked per NZS 8.4.5.2, then M_{tx} is set to M_{rx} instead of the minimum of M_{rx} and M_{ox} . M_{tx} is still set to the minimum of M_{rx} and M_{ox} , as done previously, for members that are not fully laterally restrained.
*	9466	An enhancement has been made to add the AISC 360-22 steel frame design code which covers "ANSI/AISC 360-22 An American National Standard: Specification for Structural Steel Buildings, August 1, 2022" and "ANSI/AISC 341-22: An American National Standard: Seismic Provisions for Structural Steel Buildings, September 26, 2022."
*	9933	Steel Connection Design based on the AISC 360-22 code has been added. Beam-Beam, Beam-Column and Column-base connections are covered. Both welded and bolted connections are included. Step-by-step calculation reports are produced for each limit state. Documentation and verification examples are available.
	10065	Steel Connection Design based on the AISC 360-22 code has been added. Beam-Beam, Beam-Column and Column-base connections are covered. Both welded and bolted connections are included. Step-by-step calculation reports are produced for each limit state. Documentation and verification examples are available.
*	10184	Steel joist design has been enhanced with the following new features: (1.) New joist design code SJI 100-2020 has been added, making it possible to design joist beams on the basis of their internal forces. (2.) A new type of steel joist section has been added, "Custom joist section", whose definition includes component section data. (3.) A detailed calculation report has been implemented.
	10235	An incident was resolved for steel connection design where results were not available if the design load combinations had been created automatically by running steel frame design and no user-defined load combinations were specified.
	10280	An enhancement has been made to the EN 1993-1-1:2005 and Italian NTC 2008 and NTC 2018 steel frame designs where now warning messages are shown in black color in the design report. Previously, they were shown in red, causing confusion with failure messages. Additionally, warning messages are no longer shown for the command Display Design Info > Identify All Failures, as they do not represent failure. Previously, warning messages were shown as "O" (meaning Others).

* Ticket	Description
10314	An enhancement has been made to the steel frame design codes EN 1993-1-1:2005/A1:2014, NTC 2008, and NTC 2018 where previously a warning message was issued whenever V_{ed} exceeded $0.5 \cdot V_{plrd}$ for any location in a column, or whenever V_{ed} exceeded $0.5 \cdot V_{plrd}$ or N_{ed} exceeded $0.5 \cdot N_{plrd}$ for any location in a beam. Now the design issues an error message when V_{ed} exceeds $0.5 \cdot V_{plrd}$ for any location in a column per EC8 6.6.3(4). Similarly, an error message is issued when V_{ed} exceeds $0.5 \cdot V_{plrd}$ or N_{ed} exceeds $0.5 \cdot N_{plrd}$ for any potential plastic hinge location in a beam per EC8 6.6.2(2). The new behavior is more restrictive (due to EC8 code clauses) and is reported as an error instead of a warning.
10503	An enhancement was made in steel frame design codes AISC 360-10, AISC 360-16, and AISC 360-22, where now the design amplifies the moments with B1 and B2 factors for all members when the analysis method is set to "Limited First Order Analysis." Previously, this amplification was ignored since this method applies only when all ratios of axial forces to their corresponding Euler buckling capacities were less than 0.5, and it was assumed that the amplifications were small.
10505	An enhancement was made to steel frame design codes AISC 360-10, AISC 360-16, and AISC 360-22, where now the design amplifies the moments with any user-specified overwritten B1 and B2 factors for all members when the second order method is chosen as "General Second Order Method." This applies to both the "Direct Analysis Method" and the "Effective Length Method". Previously, amplifying the moments and axial forces with calculated or overwritten B1 and B2 was done only when the second-order method was chosen as the "Amplified First Order Method." Allowing specification of overwritten B1 and B2 factors provides more flexibility to the user. By default, B1 and B2 factors are not calculated and are taken as one, if not overwritten, for the "General Second Order Method", preserving the previous behavior.

Detailing

Enhancements Implemented

* Ticket	Description
10259	An enhancement was made to detailing to be able to add or remove a beam section using detailing explorer Sections node, and to reference the added section in the Beam Views node of the detailing explorer.

Documentation

Enhancements Implemented

* Ticket	Description
10501	A documentation incident was resolved for steel frame design per the AISC 360-16 and AISC 360-22 codes where the corresponding manuals have been updated for the "Single Angles" sections to remove the phrase "unsymmetric (unequal leg)" from the paragraph in section 3.6.3, "Unsymmetric Members Subjected to Flexure and Axial Force." This modification is a documentation change only, and the calculated design results remain unaffected.

External Import and Export

Enhancements Implemented

* Ticket	Description
10172	An enhancement was made to add support for JINDAL and TATA Steel Shapes when importing STAAD (.std) files.
10539	The coefficient of thermal expansion as specified in ETABS concrete materials is now exported to SAFE for slab and beam properties when using the command File > Export > Story as SAFE V12.f2k File. This feature requires SAFE v22.0.0 or later.

Installation and Licensing

Enhancements Implemented

* Ticket	Description
10224	The version number has been changed to 22.0.0 for a new major release.

Loading

Enhancements Implemented

*	Ticket	Description
*	1870	A new feature has been added for assessing the serviceability of steel-framed floor systems subjected to vibrations caused by walking activities. The methodology follows the procedures outlined in Chapter 7 - Finite Element Analysis Methods - of the AISC Steel Design Guide 11: Vibrations of Steel-Framed Structural Systems Due to Human Activity, Second Edition. Various walking excitations and their response at different locations can be specified through the definition of excitation sets. Utilizing steady-state analysis, a walking load is applied at each excitation location and the corresponding accelerations are measured at the response location. These accelerations are then compared to established human-comfort tolerance levels. The results are displayed in an interactive form featuring a table of key calculations and various plots for visualization of the response. Results can also be displayed and exported as database tables.
*	9808	Response spectrum function for Kyrgyzstan "SNiP KR 20-02:2018" has been added.
	10237	An enhancement has been implemented to expose the short-period design spectral acceleration (Sds) input for Method 1 for computing seismic coefficients when defining auto seismic load patterns per ASCE 7-22 code. Previously, Sds input was only available for Method 2.
*	10248	Auto wind load has been added for the Vietnamese code TCVN 2737:2023.

Results Display and Output

Enhancements Implemented

*	Ticket	Description
	1671	The hinge status results for deformation-controlled (ductile) Interacting P-M2, P-M3, M2-M3 and P-M2-M3 hinges has been improved so that the hinge status is computed during each step of analysis based on acceptance criteria strain limits that correspond to location of the hinge state on its interaction surface at each step of analysis. This change resolves the issue where, in previous versions, the acceptance criteria strain limits used to determine hinge status were locked at the first instance of yielding, leading to unexpected hinge status results when a hinge yielded in one primary direction and had significant deformation in the orthogonal direction. The backbone curve shown in the Hinge Response plot (Display menu>Show Hinge Results) is unchanged and will still display the backbone curve and acceptance criteria strains corresponding to the first instance of yield for interacting hinges.
	8566	An enhancement was made to display the following tabular results for the linear static load cases that are internally generated to compute story stiffness when using the Chinese license: (1.) Diaphragm Center of Mass Displacements, (2.) Diaphragm Max Over Avg Drifts, (3.) Story Drifts, (4.) Story Max Over Avg Displacements, (5.) Story Max Over Avg Drifts, (6.) Story Forces. Additionally, the summary report has been enhanced for Chinese version of the program to display output for items 1, 2, 3, and 6 above only for the wind and seismic loads.
	10214	Auto wind-load calculations for AS/NZS 1170.2:2011 and 2021 loading codes have been added to the project report.

Structural Model

Enhancements Implemented

*	Ticket	Description
	10174	The frame auto-hinge of type "From Tables in ASCE 41-13 with EC8 2005, Part 3 Acceptance Criteria" has been updated to use the following references from EC8 2005: (1.) Table B.1 for steel beam and column flexural and P-M2-M3 hinges, (2.) Table B.2 and B.3 for steel brace axial hinges, and (3.) Eq. A.10a, Sec. A.3.2.3, and Eq. A.3 for concrete beam and column flexural and P-M2-M3 hinges.

* Ticket	Description
* 10239	An enhancement was made to add the capability for automatic generation of frame nonlinear hinges based on recommendations in ASCE 41-23. This includes (1.) Steel beam, column, and brace hinges using the reference standard AISC 342-22 as specified in ASCE 41-23 Chapter 9, and (2.) concrete beam, column, shear wall, and coupling beam hinges using the reference standard ACI 369.1-22 as specified in ASCE 41-23 Chapter 10.
10507	An enhancement was made to keep curved edges of walls as curves after performing the edit operation of meshing them into n1 x n2 segments. In earlier versions these curved edges would become straight edges.

User Interface

Enhancements Implemented

* Ticket	Description
* 10236	ETABS has been updated to support Windows .NET 8. This does not affect most users directly, except perhaps by associated changes to the Application Programming Interface (API), either by explicit use of the API by the user or through the use of third-party applications or Plug-ins. API programmers should see Ticket 10489 for more information. Users experiencing problems with third-party applications or Plug-Ins should contact the supplier for an updated application or Plug-In that will work with ETABS v22.0.0.
10256	An enhancement has been implemented to allow users to create design strip and support lines based on coordinate systems for any tower in multiple tower models. Previously, the strips and support lines could only be generated for the first tower in the model.
10273	A change was made to the Italian NTC 2008 and 2018 auto wind load patterns, removing the input Shape Factor, cp, which was redundant. The wind velocity label has also been changed from Vb to vr. These changes were propagated to the database tables and the API. The documentation has been updated, including changing the label qb to qr.
10429	An incident was resolved where there could be a long delay in displaying the Load Case Definition form for very large models when the Modify/Show button was used to access the Load Case Data form. This issue typically only affected models that had a very large number of joints.
10491	An enhancement has been implemented where tendon high/low vertical profile point values, displayed in the GUI, are now shown from the bottom of the beam if the tendon is in the beam. Previously, the profile values were always being shown from the bottom of the slab even if the tendon was in beam(s).

**Analysis
Incidents Resolved**

*	Ticket	Description
	10275	An incident was resolved where, for linear or nonlinear direct-integration time-history load cases that have modal damping enabled, the maximum considered model frequency was applied even when the "Maximum Considered Modal Frequency" checkbox was not selected. This has been resolved so the cutoff frequency is not applied if the "Maximum Considered Modal Frequency" checkbox is not selected.
	10457	An incident was resolved where, for certain models, the error message "Error in dimensioning Arrays. Check available space on disk." would be displayed when running the analysis after changing analysis options (Analyze menu > Advanced SAPFire Options). After clicking OK to close the error message, the analysis would run and results would be produced. Results were not affected. This was an internal error only.
*	10551	An incident was resolved where a model with analysis results could either (1) get inadvertently unlocked, losing results, or (2) to display a warning message when reopening the model about analysis results possibly being incompatible with the model. This issue was triggered by running the analysis once, and then running it again without changing or adding any load cases to be run. After the second run, the warning message "No load cases set to run" would be shown and the model would appear to remain locked. However, if the model was then saved and reopened, it would become unlocked and results were lost. If the model was not saved and subsequently reopened, the warning message was shown and results could be recovered by choosing that option.
*	10609	An issue was resolved where very large models (e.g. models with more than 1,000,000 point, line, and area elements and/or 10,000,000 equations) failed to run.

**API
Incidents Resolved**

*	Ticket	Description
	3040	An incident was resolved for the Application Programming Interface where third-party plugins failed to load if both the plugin and the main program were dependent on different and incompatible versions of the same assembly.
	10252	An incident was resolved for the Application Programming Interface (API) where the function FrameObj.SetLateralBracing was not actually applying the frame bracing data even though the function returned a zero (success) value. The function documentation has also been updated to include descriptions for the function parameters.
	10263	An incident was resolved for the Application Programming Interface (API) to add two new functions LoadPatterns.AutoSeismic.GetASCE716_1 and LoadPatterns.AutoSeismic.GetASCE716_1 where the argument nDir is a zero-based array, consistent with all other related API functions. In the previous functions LoadPatterns.AutoSeismic.GetASCE716 and LoadPatterns.AutoSeismic.GetASCE716, nDir was a one-based array. These obsolescent functions are retained for backward compatibility.

**Database Tables
Incidents Resolved**

*	Ticket	Description
	9996	An incident was resolved where importing the table "Load Pattern Definitions - Auto Wind - User Loads" could result in a loss of data if you specified the Number Load Sets item on more than the first record for a given wind load pattern. Now repeated specifications will be ignored if they are less than the largest previous value for the given wind load pattern, or they will overwrite previous values if larger. This affected imported database-table files, interactive database editing, and table import using the application programming interface (API).
	10209	An incident was resolved where the display of certain concrete design-detail tables would not display if any objects in the table were overstressed. This was a display issue only and results were not affected.

* Ticket	Description
10302	An incident was resolved where exporting a model to an ETABS Database table file (Access/Excel/XML/text format) was not writing the tendon vertical profile parameters C and ZC when the following conditions were met: the tendon had more than 2 spans, and the second span of the tendon had a linear tendon profile.
10436	An incident was resolved in design overwrites and preferences tables in reports where some tables that were supposed to be displayed as vertical were displayed as horizontal. This only affected ETABS v21.2.0.

Design – Composite Beam

Incidents Resolved

* Ticket	Description
10267	An incident affecting composite beam design was resolved. When a model contained one or more pairs of cantilevers and associated backspans with the backspans using composite beam design and the cantilevers using a different design method (e.g., steel frame design), then attempts to run composite beam design for the entire model caused ETABS to terminate unexpectedly. When this occurred, the error was obvious and no results were available. This incident affected ETABS v21.2.0 only. The workaround was to specify matching design methods for cantilevers and their associated backspans.
10278	An incident affecting composite beam design was resolved. When a model featured composite cantilever beams and backspans and none of the composite beams had an auto-section assigned to them, designing all the composite beams resulted in ETABS displaying the message: "Error while multi-processing design. Turn off multi-processing and design again?", at which point picking the OK button was necessary for successful completion of the design. Design results were not affected. This incident affected ETABS.
10353	An incident affecting composite beam design was resolved. When the Occupancy Category was changed in the Vibration tab of the Composite Beam Overwrites form, the values of the Damping Ratio Acceleration Limit and Additional Live Load were updated to new default values in the form but not in the model. Actually updating them in the model required returning to the form and resetting their values. This affected ETABS v21.2.0 only. When this occurred, the results agreed with the model, the strength of the designed beams was still adequate, and the model design criteria were documented in the output.
10533	An incident was resolved for composite beam design where the left deck id could not be set to None in the Composite Beam Design overwrites form. The problem was specific to the deck id on the left side of the beam - the deck id on the right side of the beam was fully controllable. This affected ETABS v21.2.0 only. For the affected beams, the deck id that was actually used in the calculations was documented in the output.
10569	An incident affecting composite beam design was resolved. Selecting the Composite Beam Design Reset All Overwrites command and then selecting the Composite Beam Design View/Revise Preferences and then clicking OK resulted in an abnormal program termination. This incident affected ETABS v14.1.0 and later. A workaround was to design some composite beams in-between selecting the two above commands.

Design – Concrete Frame

Incidents Resolved

* Ticket	Description
10587	An incident has been resolved for the Eurocode 2-2004 concrete frame design for crack width in which the moment-curvature relationship could not be calculated for certain beam sections. These sections had the sum of the top and bottom concrete covers being larger than the thickness of the sections.

**Design – Steel Frame
Incidents Resolved**

*	Ticket	Description
	10249	An incident was resolved for the "KBC 2016" and "KBC 2009" steel frame design codes where the flexural strength of wide flange sections considering lateral-torsional buckling was incorrectly calculated for certain conditions, specifically when l_{yc}/l_y was needed to compare with 0.23. Instead, the program erroneously compared l_{yc}/l_x with 0.23. For doubly-symmetric I-shapes with noncompact webs and singly-symmetric with noncompact or compact webs, and in the case where $L_b > L_r$, then M_n was conservatively calculated for the situation when both $l_{yc}/l_c > 0.23$ and $l_{yc}/l_x < 0.23$. In this case, J was taken as zero, and F_{cr} was calculated conservatively. The calculation of L_p and L_r was unaffected.
	10250	An incident was resolved for certain steel frame design codes where the moment capacity for the lateral-torsional-buckling limit state of box sections was incorrect when $I_{22} > I_{33}$. The affected codes were AISC 360-16, CSA S16-19, and CSA S16-14. The C_b factors (AISC) and the Ω_{M2} factors (CSA) were always being calculated for the M33 moment diagrams. Now they are calculated based on the moments about the major axis of bending, which is M22 when $I_{22} > I_{33}$.
	10310	An incident was resolved for steel joint design where changes made to sections in the Interactive Steel Joist Design and Review form could not be undone with the Undo command. Design results were not affected.
	10318	An incident was resolved for the Canadian CSA S16-19 steel frame design code where the section property β_w for unequal-leg angles was incorrectly taken as zero. Now it is properly determined and used in calculation of flexural strength in consideration of lateral-torsional buckling.
	10380	An incident was resolved for the CSA S16-19 and CSA S16-14 steel frame design codes in which the value of the Ω_{M1} factor was incorrectly calculated using the ratio of the factored moments at the opposite ends of the unbraced segment. It is now corrected to use the ratio of the factored moments at the opposite ends of the full member length.
	10414	An incident was resolved for the CSA S16-19 steel frame design code where the compactness of the web of I-sections subjected to bending about the minor axis was incorrectly determined for the case where the factored compressive load was less than 40% of the compressive strength at yielding. In addition, the condition of $(M_{fy}/S_y) > 0.9(M_{fx}/S_x)$ used to check for web compactness subjected to axial compression and bending about both principal axes was not implemented properly.
*	10420	An incident was resolved for the CSA S16-14 and CSA S16-19 steel frame design codes where the value of the shear stress F_s was determined incorrectly for the case of $h/w > 1014/\sqrt{F_y}$ in Section 13.4.1.1(a)(ii & iii). F_s was always set to have the value of $0.66F_y$ for almost all common design sections. As a result, the shear design was under-conservative.
	10469	An incident was resolved for the Chinese 2018 steel frame design code where the design report showed the message "Section Overstressed" for all frame members when the Demand/Capacity ratio was set to be less than 1.0. This was just a reporting issue and design results were not affected.
	10515	An incident has been resolved in steel frame codes CSA S16-14 and CSA S16-19 in which the slenderness ratio check has now been enforced as mandatory per CSA 10.4.2.1. The program previously issued a warning instead of an error. Now, the program issues an error message and fails the member.
*	10545	An incident has been resolved in the AISC steel frame design codes in which the required design strengths for braces, beams outside the link portion, and columns of an EBF based on capacity-limited horizontal seismic load effect, E_{cl} , was limited to E_{mh} ($= \Omega_{M0} * Q_E$). The E_{cl} is now calculated based only on the link strengths and corresponding seismic forces on the link per AISC 341 clauses B2 and F3.3 without enforcing the limit of E_{mh} . The computed force is no longer taken as a minimum of E_{cl} and E_{mh} . The affected codes are AISC 360-10, AISC 360-16, and AISC 360-22.

Detailing
Incidents Resolved

*	Ticket	Description
	10119	An incident was resolved for detailing where sometimes beam locations were not drawn correctly in the framing plan due to an internal tolerance check.
	10204	An incident was resolved for detailing where the Copy feature in the Beam Detailing Editor was not copying the concrete cover thickness.
	10217	An incident was resolved where the beam and column stirrup orientation could be incorrect in the EXR file exported from ETABS to Revit.
	10408	An incident was resolved for detailing where some walls were not being merged in the wall detailing plan view.
	10535	An incident was resolved for detailing where beam top rebars were not provided for non-seismic beams.

Drafting and Editing
Incidents Resolved

*	Ticket	Description
	10291	An incident was resolved where, in some cases, drawing a tendon at area-edge intersections could cause an abnormal termination of the software. Similarly, an abnormal termination could occur when drawing a tendon in a plan view for which drawing limits had been turned on.

External Import and Export
Incidents Resolved

*	Ticket	Description
	10308	An incident was resolved for Italian NTC 2018 and 2008 auto seismic and auto wind load patterns which were not imported correctly using ETABS Text File (.E2K or .SET) option. Note that this is the standard ETABS text file, not the text version of the database tables.
	10311	An incident was resolved where the PT tendon layout and vertical profiles were not imported correctly from the text model file (.SET or .E2K) when tendon supports had been edited by user.
	10326	An incident was resolved where exporting a floor to a SAFE .F2K would not include multi-step loads in a design load combination if the multi-step load case was not the last load case listed in the exported design combination.
	10397	An incident was resolved for the ASCE 7-22 response spectrum function where models with Site Class D were not able to be imported correctly from the text model file (.E2K, .SET).
	10512	An incident was resolved where a 4-noded area object with an internal angle greater than 180 degrees was not being deleted when a model text file (.SET/.E2k) was imported even though a message was presented that the illegal element was detected.
	10546	An incident affecting import of .EXR files from Revit was resolved. Revit analytical members drawn from top to bottom, or from right to left if they were horizontal, and with Y offsets at their ends were imported with axis 3 offsets that were the opposite of the Revit original offsets. (Revit analytical members local axes Y and Z correspond to ETABS frame objects local axes 2 and the opposite of local axes 3, respectively.) When this occurred, the error was visible in extruded view, the analysis results agreed with the model. This incident affected all versions of ETABS capable of importing .EXR files from Revit.

Loading
Incidents Resolved

*	Ticket	Description
	10300	An incident was resolved for the Eurocode 8-2004 auto-seismic load pattern where, when selecting "Other" as the country, the factors would get reset to zero next time the form was opened. This error only affected v21.2.0.

Results Display and Output
Incidents Resolved

*	Ticket	Description
	10255	An incident was resolved where ASCE 41-13NSP pushover curves were sometimes unable to compute a target displacement for nonlinear static pushover load cases where the monitored displacement was in the negative direction. This issue only affected ETABS v21.2.0.
	10281	An incident was resolved where, if nested load combinations were defined with more than one level of dependency and the load combinations were defined out-of-order, then the top-level nesting combination could report incorrect results. For example, this issue could occur if load combinations A, B, and C were present where combination A was referenced in B and combination B was referenced in C, and load combination C was defined before A and B. Both conditions needed to be present for the issue to occur.
	10296	An incident was resolved where displaying "General Reinforcement Details" using command Design > Concrete Frame Design > Display Design Info in DirectX graphics mode was reversing the rebar results at supports. Results were correctly displayed in Standard Graphics mode.
	10342	An incident was resolved where an abnormal termination error may occur when using the Plot Functions feature (Display menu > Plot Functions) to view results for a Staged Construction load case where the Results Saved setting was set to "End of Each Stage".
	10463	An incident was resolved where analysis results for nonlinear links could not be displayed when user-defined scaling of the force or moment diagram was requested. Automatic scaling worked correctly. No results were affected.

Section Designer
Incidents Resolved

*	Ticket	Description
	10592	An incident has been resolved for the curved wall section drawn in section designer. Previously, the location of the center of gravity of the curved wall section was determined incorrectly, resulting in incorrect calculation of the moment-curvature relationship and the axial-moment interaction curves.

Structural Model
Incidents Resolved

*	Ticket	Description
*	10284	An incident was resolved where the self-mass or mass converted from self-weight from area objects was being ignored if the area objects were tagged to be only used for rigid-diaphragm and mass assignments. Any mass explicitly assigned to these area objects was included in the analysis, just not the self mass. This issue only affected ETABS v21.2.0, not previous versions.
	10299	An incident was resolved where performing a divide operation on area or line objects followed by an undo operation would lose some assignments on the original objects. Specifically, it affected assignments of additional mass, property modifiers, and insertion-points on areas (shells) as well as assignments of additional mass, property modifiers, partial-fixity springs, insertion points and joint offsets on lines (frames).
	10451	An incident was resolved where additional lateral mass may have been erroneously added to the top story of a model if the model had joints with mass that were located at an elevation that exceeded the height of the top-most story in the model, and also the option to "Lump Lateral Mass at Story Levels" had been enabled for the particular mass source that was used for analysis. (Define menu > Mass Source). When this issue occurred, the additional mass was reflected in the "Mass Summary by Story" and "Assembled Joint Masses" display tables.

*	Ticket	Description
	10527	An incident was resolved where, for a frame object assigned with a Section Designer type of frame section, the "From Design" option for rebar ratio for creep analysis (Assign menu > Frame > Column/Brace Rebar Ratio for Creep Analysis) may give a rebar ratio that does not correspond to the rebar actually used in the section. The rebar ratio used for creep and shrinkage analysis agreed with the value listed in the Frame Information form (right-click menu for the object).

User Interface

Incidents Resolved

*	Ticket	Description
	10231	An incident was resolved where the mouse wheel did not work for zooming in or out of a plan view when using Standard graphics mode. Elevation and 3D views were not affected. DirectX graphics mode was not affected.
	10243	An incident was resolved where the tendon system could not be changed from bonded to unbonded when editing the tendon by right-clicking or through the Edit menu. The system could only be changed from the default unbonded to bonded when the tendon was edited for the very first time or when using interactive database editing.
	10272	An incident was resolved where changing the story height in a model with PT tendons could cause an abnormal termination of the software.
	10340	An incident was resolved where, when an incompatible panel-zone type was assigned to multiple hinges, the "Error in assigning panel zone" pop-up message was shown multiple times in sequence. This behavior has been improved so that a single pop-up message is shown with the number of panel zones that were unable to be assigned.
	10394	An incident was resolved where an abnormal termination of the software could occur if, while working with the Mass Source Data, the Modify button was clicked when there were no load patterns in the list. Now the Modify button is disabled in such a case.