TQS NEWS

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Editorial

Eng. Henrique Covas

Dear Friends,

We have reached the year 2026 and, with great pride, TQS celebrates this year the important milestone of
40 years of its operation. It has been 40 years making history and helping in the development of Brazilian Structural Engineering.

It is also impossible not to mention another commemorative date in 2026, the 80th birthday of one of our founders, Nelson Covas.

Congratulations to Nelson for this brand and for following, daily, with the same ideals and teachings, always seeking to add and value Structural Engineering.

All of you, customers, friends and readers of *TQSNews*, are also part of this achievement that deserves to be celebrated.

No doubt these brands make us very proud of these shining stories, but we always keep our eyes on the future. As a technology company, it is our commitment to always keep an eye on our systems and to incorporate the latest innovations available into our systems.

In this issue, we highlight TQS software's role in analyzing the growing number of tall buildings in Brazil. Even in challenging projects, it has proven its capacity to process structural forces and support engineers in these complex designs.

In addition, we have an important study developed by an independent consultancy, comparing TQS to another *world-renowned software* for structural analysis, with results that attest to the reliability of TQS in the verification of forces and displacements of reinforced concrete buildings.

This year in Brazil, despite an election that may bring momentary unstable, we have the prospect of the beginning of a cycle of falling interest rates, which may lead our sector to continue growing and with good prospects for all of us.

Recently we also had the news of the increase in real estate financing by Caixa, which should leverage more projects and works to increase coverage and reduce the Brazilian housing deficit.

This is good news for our industry; We hope that, in the next government, it will improve even more.

Also maintaining our policy of continuous improvement, we have had meetings with several customers in recent months, to hear suggestions for improvements and thus, increasingly, avoid reworking, eliminating edits and have resulted in closer to the real needs of our customers.

We continue, as everyone knows, as an open channel for the exchange of ideas in search of constant improvement in the systems.

In our support sector, we are implementing the compilation of data from all our knowledge history with AI, to have each time more agility and assertiveness in responses, further improving our after-sales.

We continue here in the development of version 27 of the systems, with good innovations and improvements. The idea is to have great news for our customers with the optimization of editors – increasingly focused on increasing productivity and reducing rework, improving the output of results, improvements in TQS Python and AI alternatives, always with great responsibility and caution, but helping and accelerating decision-making by the engineer.

We will also be present at Enece, Concrete Show and Ibracon, where we hope to welcome our friends and customers to our booth to celebrate our 40 years together.

See you later!

TQS 40 anos

Highlights

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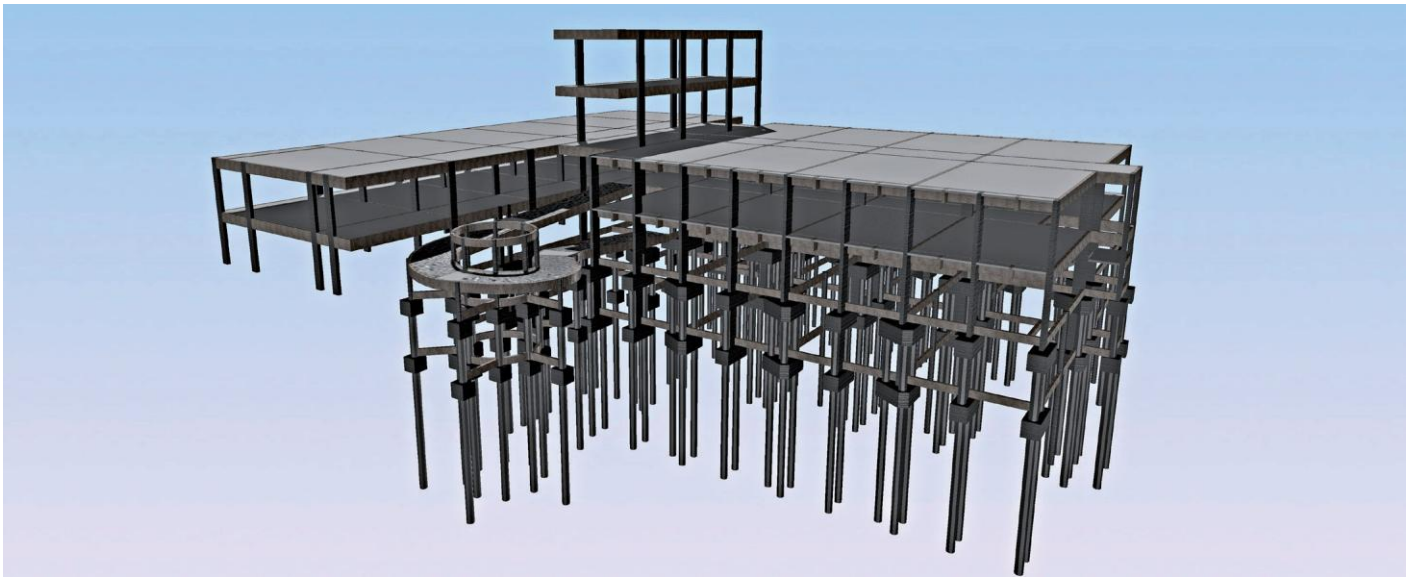


VR de Jesus Engenharia, Petrópolis, RJ

On the master's path

Interview with engineer Aurélio Franceschi
By Mariuza Rodrigues

Engineer Aurélio Franceschi went on a journey of spiritual learning and professional to consolidate as one of the engineers specialized in various kinds of structure.

In times of the speed of Artificial Intelligence (AI), it can be difficult for young professionals visualize the long journey they have ahead of them, as soon as they graduate, especially in the field of Structural Engineering in which specific knowledge and technology go hand in hand. One cannot survive without the other. But how to position yourself in this new cycle that does not have any parameter in history?

Perseverance, ethics and mirroring the best Professionals, according to Franceschi, are the main steps for those who are at the beginning of their career. Today, close to celebrating 40 years of profession, the engineer points out that the trajectory of each one can be one of success and satisfaction according to the level of transparency, heart and reason that they adopt in their attitudes. For him it is not only a matter of his profession, but also of his spirit, something he learned from the good old master Shido Ogura.

The testimony of engineer Aurélio Franceschi, from the AS Estruturas office, sheds light on this new evolutionary moment not only in engineering, but in the history of the world. An engineer trained in the 1980s, he was punctuated by his master, then boss, and later partner Shido Ogura, to whom he credits a solid base of knowledge, but above all of trust. "I consider him my 2nd father," he says. A young man passionate about engineering and studies, Franceschi was traveling through the real universe and realizing the great gap between the market and academia. So much so, that he has never stopped teaching and seeks to transmit the knowledge acquired throughout a solid career, whether through university, through private classes or within his project office.

Eng. Aurélio Franceschi

With the AS Estruturas office consolidated in Curitiba, the professional works in the most varied technical specifications, from the real estate market, infrastructure, and high-rise building projects, a more recent trend in the country.

In his view, the professional can and should seek specialization as improvement and only then move on to other stages of specialization, giving time to the consolidation of knowledge. The expansion of technology can accelerate this process, but, in turn, it requires care, attention to the rules and above all an accurate and critical eye, in order to avoid the risks inherent in haste and lack of experience. Follow the interview with engineer Aurélio Franceschi below.

Why did you choose Engineering as a profession? Where and when did you graduate?

I chose engineering because it is an area in tune with my best performance in academic training prior to entering the University. I had no peers or acquaintances in the area; I had no idea what an engineer accomplished professionally. So, I was in doubt between Chemical and Civil Engineering, opting for civil. Today, after this experience, I believed a lot in intuition and it gave it to me, because I understand that I made the right choice.

And what is your motivation to follow the path of Structural Calculation Engineering? Any personal inspiration or professional influence?

Structural engineering came into my life after my excellent performance in the discipline taught in 1986 by Professor Shido Ogura: six 10.0 grades in six tests. At the end of the course, he invited me to intern at Tesc, a reference project office since 1958, where I remained by his side until his last days of work. Since I was a student, I have had great personal and professional harmony with him, which resulted in friendship, partnership and admiration. I consider him my second father, and I am very honored by this joint trajectory.

At that time, did you already know the reality of this segment? How did you find out about the subject?

Not deeply. I analyzed the people who worked in the area, their reputations and their lives on a daily basis. I don't believe in surveys and numbers issued by the media or internet mentors.

I believe in the conversation and analysis of real cases of everyday life, and these were the ones who guided me, like Professor Shido Ogura.

Structural engineering came into my life after having obtained an exceptional result in the course taught in 1986 by my teacher Shido Ogura (six grades of 10.0 in six tests).

How was this internship in this area alongside your master Ogura?

As I mentioned above, I started this internship at Tesc in 1987, at the time under the command of Shido Ogura and Moacir H. Inoue. It was undoubtedly a period of great learning and adaptation, because at the time I prioritized academic performance at the office. It was essential to understand the work dynamics of a structural engineer, and, in this sense, it was essential to choose a career. It was a privilege to have joined a firm of professionals with integrity as a person and technically above the market average.

After college, have you already moved towards a specialization in this area?

Two years after graduating, the opportunity arose to carry out a specialization in Curitiba, where I was already working professionally. Unlike today, the offer of courses was much more restricted by distance and means of communication.

Did you already have an academic career in mind?

Since he was 15 years old, he worked in the teaching area, teaching private lessons to supplement family income. At the time, I followed the reference of my mother, who taught in elementary education. From then on I worked in this activity in parallel with my sudies and in the period of studying, becoming a reference in this activity. When I joined Tesc as an engineer (1988), my dream was to follow in the footsteps of master Shido Ogura and professor Moacir Inoue, who taught at the Federal University of Paraná. However, the changes in the way universities hired professors frustrated my expectations and it would only materialize in 1995, when I joined UFPR (Federal University of Paraná) as a professor of Structures. Even so, I continued my teaching activities in other institutions.

How did AS Estruturas Engenheiros Associados come about? Did you always have in mind to be an entrepreneur in this area?

The company AS Estruturas emerged in 2004, when the four partners of Tesc – Shido Ogura, Moacir H. Inoue, Jose Augusto Prazeres and me, Aurélio Franceschi – decided to divide the client portfolio, which had been formed since 1958, and to create two companies. One was under the command of Shido Ogura and Aurélio Franceschi (AS Estruturas) and the others under the command of Moacir Inoue and José Augusto (Tecni-calc). Today we realize that it was a very wise decision, because the two companies are larger than Tesc, which, at the time, was one of the largest in Paraná.

3D Model - AS Estruturas

In general, this moment of transition of students to be professional or partner of a firm is the most difficult point of their career. Were you prepared for these challenges at the time?

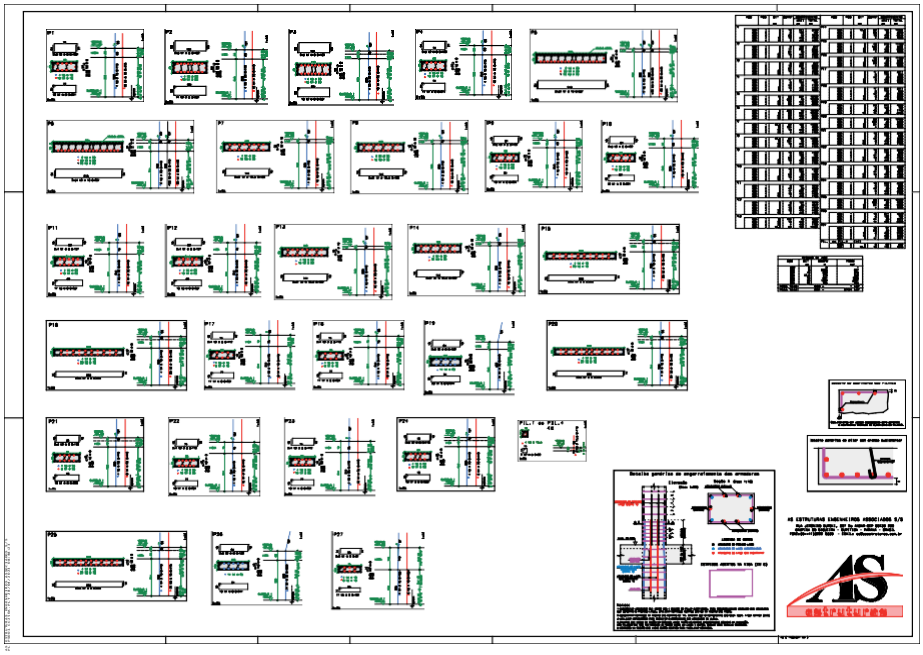
As I said above, I believe more in intuition and in day-to-day experiences choosing a career or place to work, rather than market analysis or listening to influencers from the internet. For career choice, I consider that the true mentors are the professionals with whom we work in our daily lives. These are real-life people and cases. The most difficult point of the career is to be able to have patience and give time to time, to acquire professional advancement. Nowadays it is even more difficult in relation to my career, because speed and technological advancement are above human capacity and teaching has dropped a lot in quality, creating an abyss between knowledge and the reality of day-to-day work.

What was the strategy to consolidate a personal name or brand in such a competitive segment?

Hard work, constant study, ethics, perseverance and passion for what I do. Innovation is the key for a design company to endure and compete with excellence.

Was there any area in particular that caught your attention?

No!! I work in various types of buildings and various structural systems. But always incorporating new systems is essential. I remember a theme: in 2014 I got to know the system of relieved slabs and fell in love with the theme, but it did not develop in Brazil, as it was



Column Reinforcement - AS Estruturas

developing in the rest of the world. I strongly believe in the future of this system that today is restricted to Bubbledeck.

Partnering with other colleagues helped in this process professional?

I was very well received at Tesc not only by its directors, but by all my co-workers, who helped me to become a professional from a student. The challenges and interaction with the engineers and architects of the companies that hired us generated a lot of learning and technical development.

Does the firm operate in several segments?

Yes. This profile also requires greater knowledge. The secret lies in acquiring knowledge from one system at a time. And only after this system has been absorbed and concomposed, then move on to the next one.

How to serve such diverse segments and at the same time keep the unit operational?

This seems to me the most difficult thing for us engineers because we were trained to be engineers and not financial or people managers, and so we do not know how to correctly quantify the value of our work.

Our sense of responsibility and commitment leads us to perform more hours and extra tasks that are not properly paid. Before we were a project office (1980s). Today we must be a company and there are big differences.

Since he was 15 years old, he worked in the teaching area, teaching private lessons to supplement family income. At the time, I followed the reference of my mother, who taught elementary school.

A capital factor is that the market has been invaded by professionals with little training, but great pilots of powerful machines, who quickly issue projects. The client, not being able to evaluate whether projects in this format are right or wrong, hire at the lowest price, pushing the market to values that are currently inadequate.

This reality needs to change, and it is up to us professionals to show the market the need to improve the value of the project, so that the offices are strengthened in professional qualification and acquisition of high-level equipment.

At what point did the application of *software* technologies become even more common in the office?

In my personal experience, the first step was in the opening of the market and internationalization of Brazil, carried out during the Collor government, which provided greater access to physical and technical resources. The second moment was the emergence of the Internet, which revolutionized the means of communication and access to information. We have passed from the analog system to the digital system, in a shorter period.

Is there any script that facilitates this interaction between professionals and operating systems?

Yes! It starts with choosing consistent, constantly updated *software* aligned with normative changes and calculation techniques. Then comes the correct configuration, since the program responds to the parameters entered and can deliver wrong projects if misconfigured. Finally, engineers must apply knowledge and critical judgment to verify whether the *software* is producing correct results.

What attracts you to a career as a teacher?

I believe it is an opportunity to learn. Because to teach, the teacher needs to study the subject more deeply and, when questioned by the students, new questions arise and this makes the content and understanding evolve.

Is the segment in need of updating?

Formal education in universities is currently composed mostly of professors who do not work in the project market and thus become more theoretical than practical. The correct thing would be for engineering schools to have PhD teachers

working together with market engineers, thus being able to pass on to students the scientific technical knowledge applied within the reality of everyday life.

Unfortunately, the government implemented a system that purged professionals from academia. Lato *senso* courses taken by professionals or entities try to fill this gap left by formal education, but they are still small in number, difficult to access and with a cost of time (students do not have the patience to learn in due time, in my opinion) and financial cost, outside the students' ability to pay.

For career choice, I consider that the true mentors are the professionals with whom we work in our daily lives. These are real-life people and cases.

Associations such as Abece (Brazilian Association of Structural Engineering and Consulting) – have been working to carry out these courses. I believe that recognition of these courses by the Ministry of Education (MEC), granting a master's or doctorate degree to its students, can help to solve the two issues I presented above. Some projects are equivalent to master's theses and the MEC, in my opinion, could grant the authors of these projects master's degrees or doctorates equivalent to theses, which would also facilitate and motivate more integration between academia and the market.

Technology can be a partner for professionals. but it also offers risks. How do I deal with this diffusion of AIs in all stages and sectors of daily life today?

Technology is a partner in what computer programming can generate: reduction of time for activities and routine calculations. But for this they must be supported by algorithms properly based on physical and mathematical concepts. If you program it wrongly, it can be even faster, but it will come out with errors.!!! Risks? They are constant and command care. They must be mitigated with constant checks against the results obtained x manual calculations or x analysis of expected results and verification of imputed data.

Regarding everyday life, I am concerned about the ease of communication – such as whatsapp, e-mails, Instagram, etc. – which in addition to requiring immediate responses 24 hours a day, generating stress, is formulated in an incomplete and impersonal way, generating misinterpretation and consequent friction. I see that we would have to restrict the answers to a specific period of the day, so that most of the time we could devote ourselves to the work itself.

With so many technological possibilities, we see a diffusion of tall buildings in the country.
Could you explain why?
Costs, technology, return?

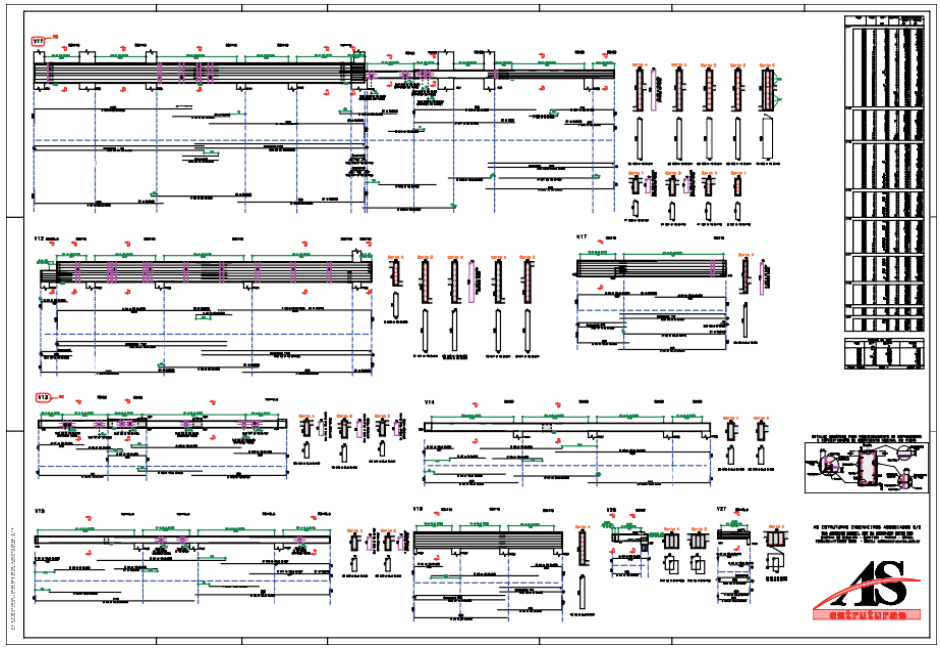
Participamos de projetos de edifícios altos desde 2009. Nos últimos anos eles vêm se multiplicando. Na minha leitura isso acontece devido a alguns fatores:

- the 1st of them is that developers choose tall buildings to create a differentiated product in relation to the market, with a differentiated appeal in the sale.
- the 2nd reason is the dilution of the cost of the land, building the maximum possible square meter.
- the 3rd reason is that although the costs, in terms of structure, are higher than in other buildings, these costs are probably offset by other gains in other materials or processes.
- and, finally, the sale value of the square meter of this type of building is differentiated and without a doubt this is another factor that attracts developers.

And, finally, it is to keep in mind the focus on our daily lives, where it is essential to use our knowledge and critical sense to know if the software is delivering correct results.

Has Brazil followed this evolution in terms of professional, machinery and systems?

He certainly did. Brazil is integrated into the

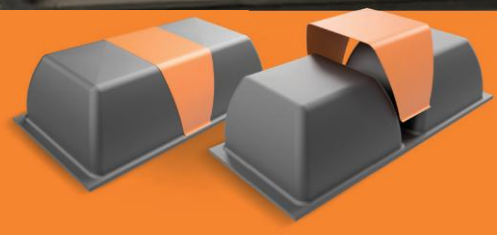


Beam Reinforcement - AS Estruturas

LANÇAMENTO

Fôrmas Atex 610 B125U

Mais possibilidades
para o seu projeto estrutural.



Mais **controle**
no projeto.
Mais **eficiência**
na estrutura.

As novas alturas ampliam as possibilidades de dimensionamento em lajes nervuradas, garantindo **maior controle estrutural, redução de consumo de concreto e aço e mais produtividade na execução.**

Altura do Molde	Espessura da Lâmina	Altura Total	Largura da Nervura			Área da Seleção	Área da Seleção		Inércia		Peso Próprio	Volume de concreto
			Inferior	Superior	Média		Face Superior	Face Inferior	Inércia p/ nerv.	Altura Equivalente		
cm	cm	cm	cm	cm	cm	cm^2	cm	cm	cm^4	KN/m²	m³ / m²	Altura do Molde
10,0	5,0	15.0	12,5	15,8	14,2	446	4,8	10,2	6959	11,1	1,83	0,073
	7,5	17,5				599	5,8	11,7	11214	13,0	2,45	0,098
	10,0	20,0				751	6,9	13,2	17277	15,0	3,08	0,123
15,0	5,0	20.0	12,5	17,1	14,8	527	6,6	13,5	16630	14,8	2,15	0,086
	7,5	22,5				679	7,3	15,2	23901	16,8	2,78	0,111
	10,0	25,0				832	8,2	16,8	33079	18,7	3,40	0,136
20,0	5,0	25.0	12,5	18,3	15,4	613	8,5	16,5	32365	18,5	2,50	0,100
	7,5	27,5				765	9,0	18,5	43962	20,5	3,13	0,125
	10,0	30,0				918	9,8	20,2	57470	22,4	3,75	0,150
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	7,5	32,5				859	10,9	21,6	72929	24,3	3,53	0,141
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30,0	5,0	35.0	12,5	21,2	16,9	811	12,6	22,4	87685	25,8	3,33	0,133
	7,5	37,5				963	12,9	24,6	112419	28,1	3,95	0,158
	10,0	40,0				1116	13,5	26,5	138913	30,1	4,58	0,183
d1	ds	D	bi	bs	v	A	rs	ri	I	heq	Concreto 25 kN/m³	

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- Mais de 11 milhões de árvores preservadas.

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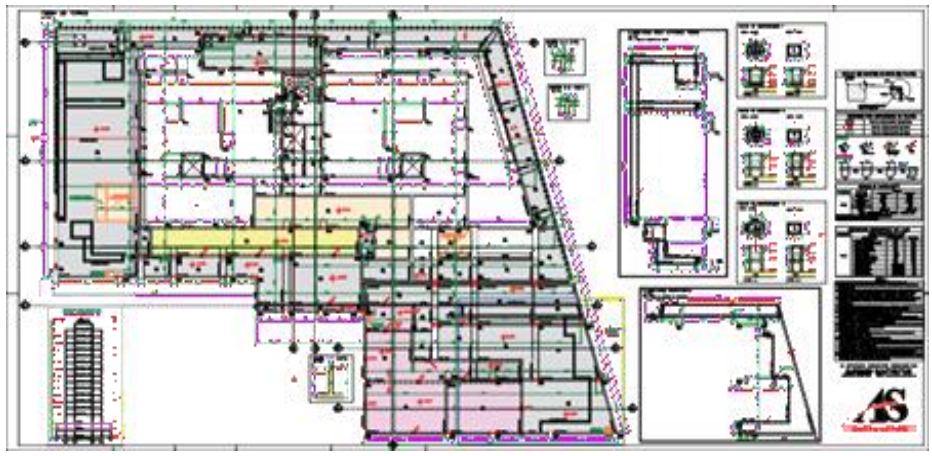
world evolution of engineering, architecture and real estate developments. A reflection of this is the arrival of professionals from other countries attracted by our market expansion. Our *engineering software* is starting to become global, and this shows the evolution we are experiencing. The tallest residential building in the world is under construction in Brazil (Senna Tower).



Ground Floor - AS Estruturas

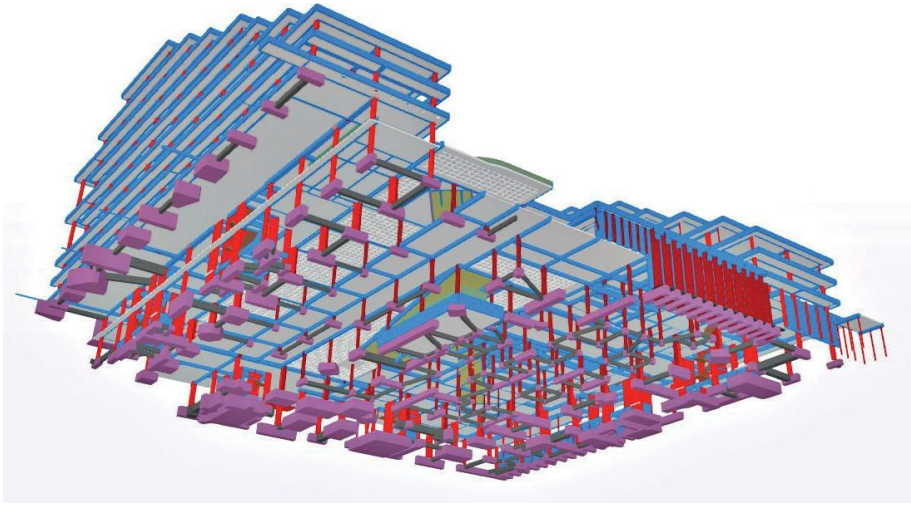
But there is a bottleneck, which is the number of qualified professionals to meet the demand. At this point, I see deficiency that is generated by low remuneration and lack of resources for training that are so due to the inadequate remuneration of the market for projects.

In your opinion, what technological stage in Engineering is Brazil? What is needed to meet this new demand or cycle of evolution?

Moving forward according to the needs presented by the projects. To continue advancing, we need to continue to have opportunities. That is, if we have work, we can exercise our expertise. But there is a bottleneck, which is the number of qualified professionals to serve the demand. At this point, i see a deficiency that is generated by low remuneration and lack of resources for training that are so due to the inadequate remuneration of the market for the projects. Therefore, there is an urgent need to improve the value of the projects under penalty of the collapse of the system.

Do academia and the market talk to each other in this sense?

My vision and day-to-day experience say no. Professionals who apply to work with us or who already work with us come with deficient content for the necessary tasks. We practically must have a school within the company. The interns tell me that they learn more in quantity and quality inside the offices in their internships, than in the classrooms.



3D Model - AS Estruturas

In the professional sphere, are professionals motivated in terms of remuneration to expand this line of knowledge and action?

Project offices today do not work with adequate remuneration for their professionals, because the value of the project is inadequate. Firms cannot have the time and resources to invest in professional improvement, so things only happen with a lot of sacrifices from professionals.

What are the most interesting projects then?

The best paid projects are those that have a smaller number of offices or professionals who have the capacity to develop with notorious effectiveness. Tall buildings can be listed as a typicity with these characteristics. Next to it, I cite works of art or projects with short deadlines.

When a project like this starts to get off the ground, what would be the starting point?

Joint and integrated work, of all designers and the builder, from the 1st trace of the project.

What would you say to a young person who is entering the area of structural engineering today and still does not have a path defined next?

Understand that the speed of career ascension does not

happen at the speed of today's digital world, he needs a lot of study, patience, time and especially dedication to improve and increase his knowledge, especially in physics, mathematics and human relationships, because engineering school provides him with the general basis. In my opinion, professional residency should be created, as is the case in the medical course, in order to ensure greater improvement for recent graduates.

Certainly, the path is one of specialization. If I had to send this message to myself, I would say: do everything as you did, since you did it with will, dedication and without thinking too much, but choosing the best possibilities that arose over time.

How is the project management process, especially regarding BIM (Building Information Modelling) and systems for exchanging and storing project information?

The tools that we currently have at our disposal and promise to speed up the work are great, but they are very badly used, because the chain of producers of the projects lacks the professional competence necessary to effectively carry out the projects. These tools are the equivalent of Formula 1 cars but driven by newly qualified drivers.

Projects today have an absurd number of revisions, which are often not properly indicated, forcing each version to require the entire project to be revised from scratch. This generates waste of time and very high costs. A simple but efficient suggestion is that everyone who generates changes in their project explicitly writes them down in the cloud so that those who will manipulate them can go directly and exclusively to the changed points.

And how to reconcile technology with the professional's personal knowledge to consolidate one's career?

Dedication and resilience are the key words which allow you to discover and enhance your skills. Technology has provided us with very effective tools in data processing and with that the simulations of structural options have become much more accessible.

What was most worthwhile and what could be modified?

I would like to highlight the friendships created and cultivated during the career as one of the most favorable points. And the other point is to have participated in the evolutionary movement of engineers, because I had the privilege of living the analog world at the beginning of my career and today experiencing the digital world. What could be modified? Nothing, because what was done was done with the best of intentions, always seeking to do the best.

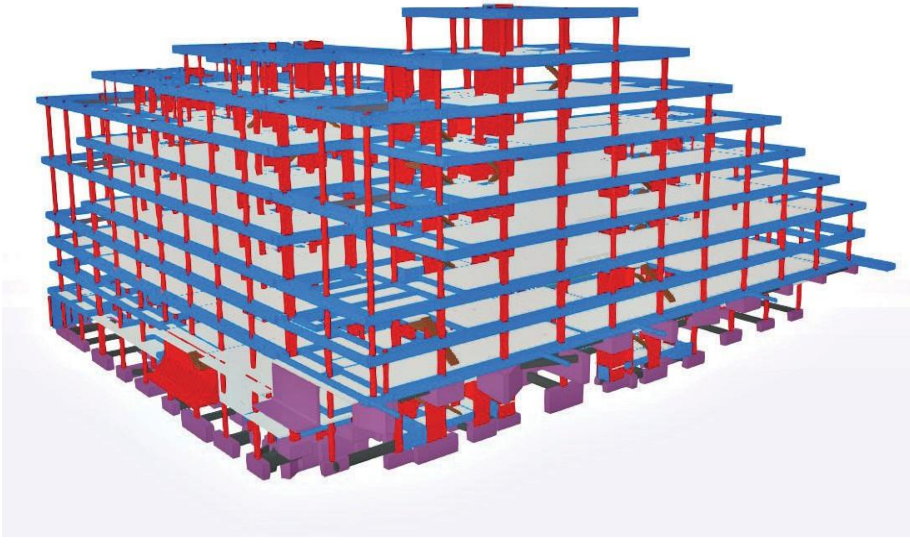
What memories do you have of engineer Shido Ogura and what is his importance in your career?

Memory of the serenity and know-how of a master's in engineering and in his personal life as teacher who became a friend, A teacher who became a friend, advisor, a true example, always showing me the positive side. I learned that youth is not in age but in the spirit of the person. I consider him my second father.

The tools that we currently have at our disposal and promise to speed up the work are great, but they are being very poorly used, as the chain of producers of the projects lacks the professional competence necessary to effectively carry out the projects.

How does the firm project its future going forward? Where can you expand?

We live today in a market that I consider very aggressive, where price is prioritized over quality. Recently, I hired a consulting firm to design a strategic plan for the next five years. I am sure that this can help us to continue to write a success story of our current and future professionals at AS Estruturas. We will remain aligned with the same mothers that we have acquired and formed our DNA so far, because of the effort and talent

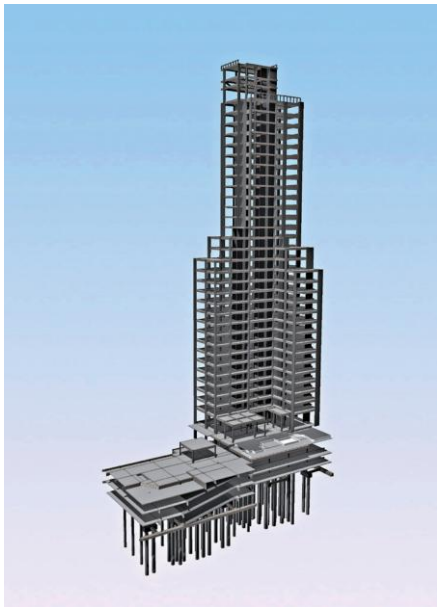


3D Model - AS Estruturas

of each one of us, allied to the teachings, technology and principles, and teachings transmitted from generation to generation, which began at the end of the fifties of the last century, when Ernesto Sperandio and Jose de Almendra Freitas Neto founded Tesc, followed by Shido Ogura and Moacir Inoue. Later, both took me to Tesc in 1988. And with Shido Ogura in 2004 we continued together at AS Estruturas, where he stayed with us until 2021, when he left us, but left a strong legacy.

Public investments are recovering in the area of Infrastructure?

Despite some works such as the Guaratuba Bridge (PR) and some private ports in Santa Catarina, I see in the South of Brazil a very large deficiency in the amount of infrastructure works. Timid airports with delayed work, BR101 in two runways in a state of shame. This condition generates a very large delay in proportion to the wealth generated in the South of Brazil.



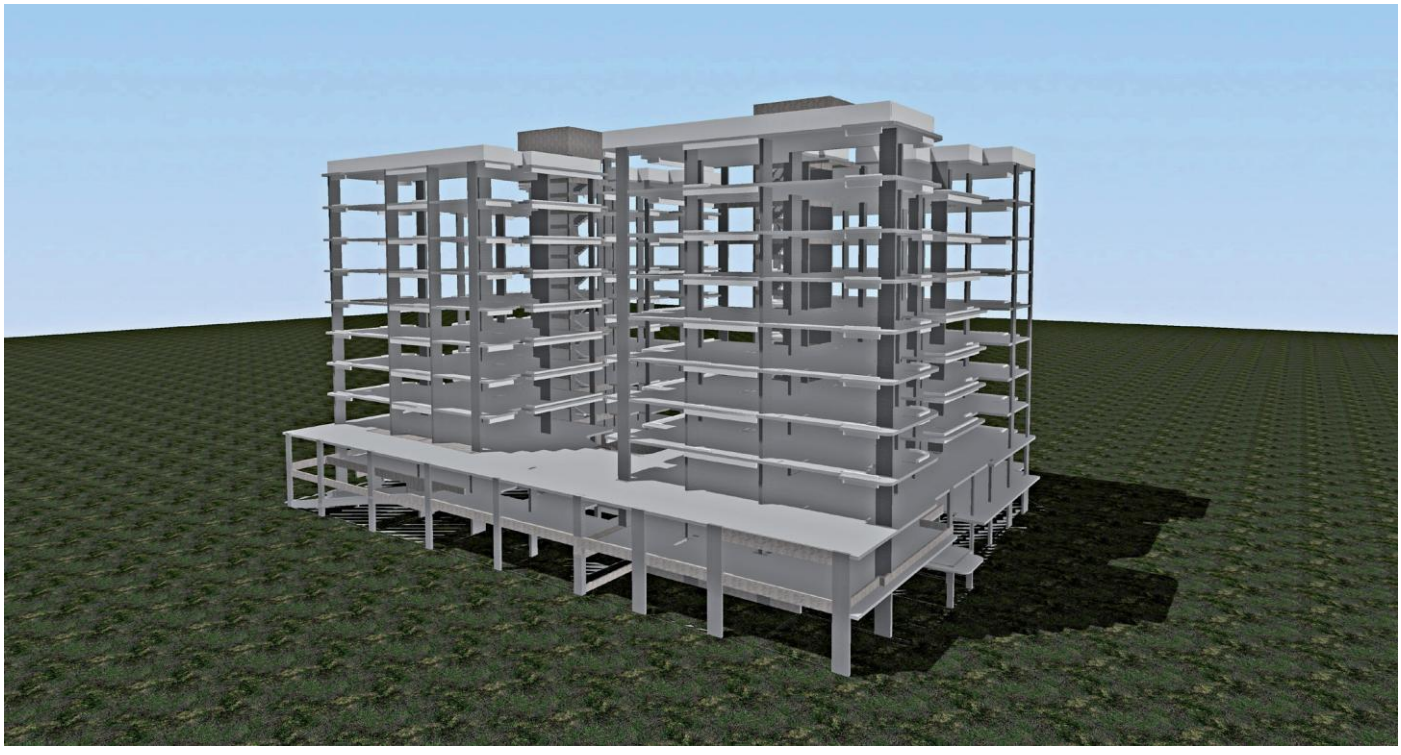
3D model - AS Estruturas

Is the path specialization or the generalist professional? If you could send a message to the young Aurélio about 40 years ago, what would you say to yourself?

Certainly, the path is one of specialization. If I had to send this message to myself, I would say: do everything as you did, since you did it with will, dedication and without thinking too much but choosing the best possibilities that arose over time. The trajectory that a person follows is one of success and satisfaction according to the path he chooses to follow with transparency, heart and reason, always doing the best he can. I don't recommend looking at what others do and trying to copy them, because each one has their own path and must build it according to their profile.

What was most rewarding and what would you change, if you could, on this journey?

The most rewarding thing is the recognition of the market for the work done by seeing my projects bear fruit for those who entrusted them to me. In addition to being able to inspire professionals who work or have worked with me to improve permanently, based on knowledge that I was able to transmit to them and that, in turn, will transmit to other people. As I told you earlier, I wouldn't change anything in my trajectory. I am very happy and proud of the long road I have walked and still must walk.



HC Estruturas e Consultoria, Vitória, ES

After the release of the V26 version, our development team remains focused on analyzing all user feedback with due attention, as well as committing to providing the necessary periodic maintenance in an agile way. It is worth mentioning here the selfless work of all those who are part of our testing team (development and support engineers), which guarantees delivery with the highest possible quality. At the time of printing this newspaper, revisions V26.1, V26.2 and V26.3, V26.4 and V26.5 had already been made available. It is recommended to always keep the system up to date. Also noteworthy is the release of V26.3 in Spanish for users in South America.

In addition, we inform you that we have already started the development of new features for the future V27 version. Our development team is in an intense moment of studies and research. Our main goal, as always, is to try to meet as many user demands as possible.

V26 Revisions

See below the main news of the V26 version revisions that were recently made available.

V26.1

Structural Modeler
- Adjustments to mirroring and rotation of foundations.
- Preselection adjustments for multiple different objects.
- Improved level symbol creation on auxiliary floor.
- Adjustment in the dynamic preselection of reference drawing and elements in auxiliary floor.
- Removed 3D object title cuts us.
- Turned off the dimensions of columns transition blocks when the dimensions of the associated column are also disabled.

Graphic Editor
- Correct rotation of relative quotas.
- Hit in TQS font preview when plot interpretation option is enabled.
- Disabled rotated local system in 2D mode view.
- Corrected the operation of command modifiers in the properties panel.

Smart Reirforcement
- Representation of Bending Radius in Stirrups.

Python
- Getting the routine right TQSJan.ChangeDwg().

Plant Editor
- Adjusting the alignment of texts in the floor plan revision table.

Slabs
- New criterion that allows changing the estimated flexural gauge in the punch design.

Prestressed Slab
- Adjustment in the anchor design with greased strands in the straight section outside the formwork.

Incremental analysis
- Improved processing time for constructive analysis.

V26.2

MetalCheck
- Adjustments in diagrams of steel beams with IV model receiving slab loading.

V26.3 (Portuguese and Spanish)

Graphic Editor
- Hit Undo command in command groups that included the partial Move command.
- Text capture hit in 2D mode.

Structural Modeler
- Disabled the ability to traverse F2 track when editing foundations.
- New notice for beams with a height of less than 12 cm.
- Improved data consistency on thrust load insertion.

Incremental/constructive analysis
- Adjusting the display of MULAXI and VMULE-TR values in the Viewer.

Quick column reinforcement editor
- Only one 2nd Order Effects Viewer allowed it to be opened at a time.
- Adjust command to check all column-wall strips when single pressure/pull failure.

Smart Reinforcement
- Adjustment in the radius representation of tribesmen's folds.
- Correct rotation of distribution lane description text in interactive commands.

BIM
- IFC File Export Adjustments.

Sises
- In the poll editor, the option to display all calculation methods has been added.

Other
- Improvements and specific adjustments in TQS, Alvest, Concrete walls, Prestressed slabs, Welded meshes, MetalCheck and Preo.

V26.4

Model 6

- Adjustment in the transfer of forces in trans beams for visualization in the Prestressed Slab Editor.

V26.5

Model 6

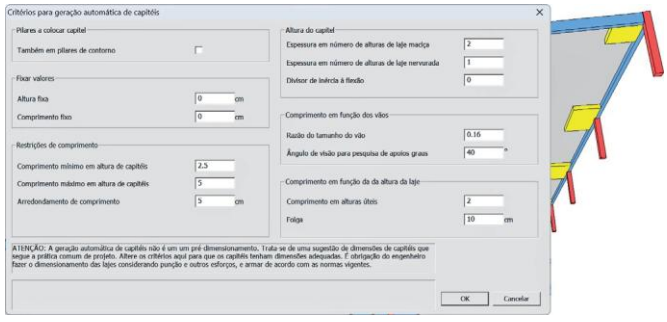
- Adjustment in the consideration of loads due to prestressing in transition beams.

The V27 in development

Here are some of the features that are under study/development and that may be made available in the future V27 version.

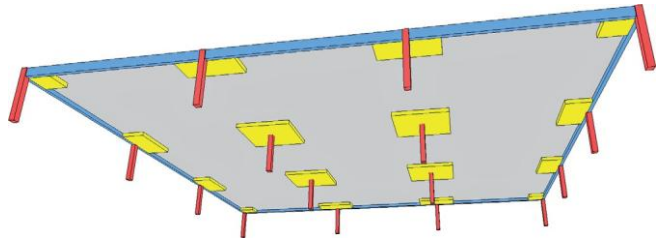
Modeler

In the design of a slab with capitals, the program can suggest the position, size and distribution of capitals on the slab. It is not a pre-dimension, but a pre-allocation based on common mushroom slab design parameters:



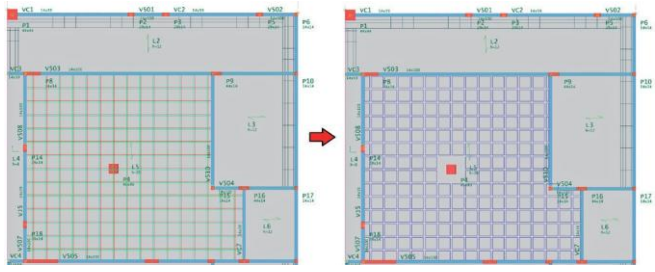
RF Engenharia e Projetos, Cotia, SP

We have control, for example, of the thickness and size of the capital depending on the spans and useful height, in addition to generating or not capitals in columns in the contour. In ribbed slabs, rib forms are eliminated in the capital region.

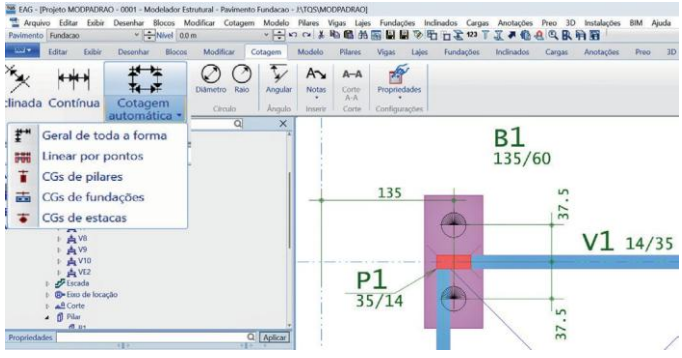


It is a quick way to enter capitals that can then be verified, dimensioned and detailed by the system.

The modality of distribution of forms for ribbed grid slabs was introduced. A new command previews the position of all the ribs of a slab and its axes. This allows you to visually align rib shafts with important supports in both directions, refining the grid model.



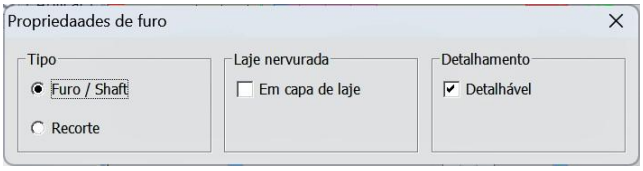
Created commands for automatic dimensioning of gravity centers of columns, foundations, and piles in relation to the defined axes.



The modeler now anticipates some problems with defining thrust loads that were previously detected only in processing. And now, any side-loading case can be used as a push.

A criterion of minimum dimension of consideration of holes was defined in the analysis. It is not only a matter of not detailing reinforcement around the hole but also considering that the hole will not interfere with the grid model. The hole will still be in the shape plan and will be exported to the 3D models.

Holes have a property box, where we can define whether they are detailable or not, after they are inserted.

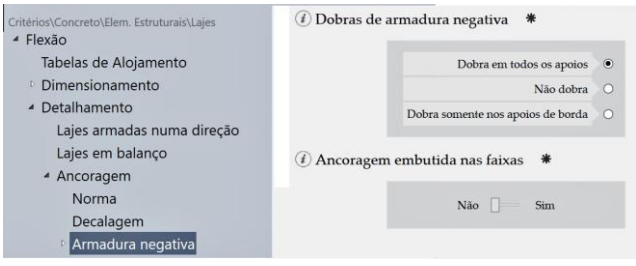


This data can also be changed after insertion through the properties panel. The engineer can decide whether the hole should be reinforced or not.

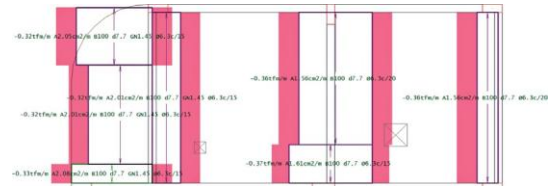
Slabs

Introduced auto-saving data for Quick Editing of Slab Reinforcement. The files of the graphical edition from time to time are saved with the name "AutoSave of ...". Restoring these files without the prefix causes the data to return to neither the state prior to the last save.

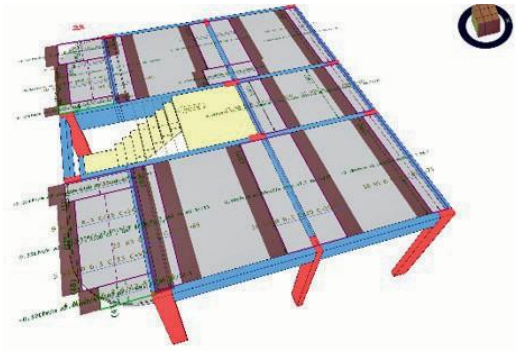
In the anchoring of negative reinforcements, we have two novelties: The folds can be suppressed, and the forces can embed the anchorage:



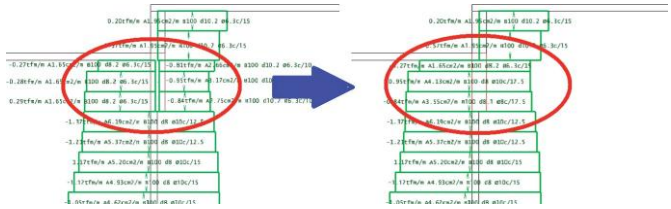
Typically, the ranges of negative bending forces extend to the null moment point, and the reinforcements are extended by anchoring and decaling. We now have the option of pre-embedding the latter in the strips, so that we have the exact notion of the size of the reinforcements even before refining the homogenization of the force strips:



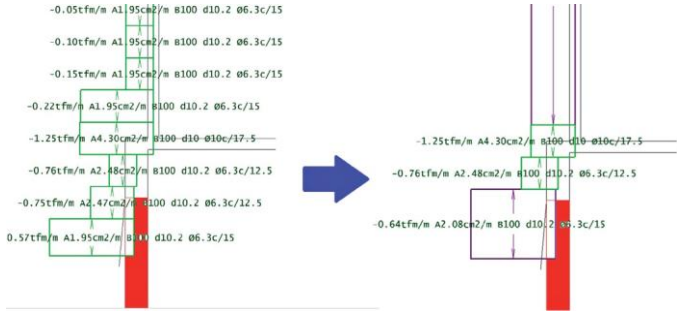
The built-in anchor is shown with different colors on the track. V27 Quick Slab Reinforcement Editing is in 3D:



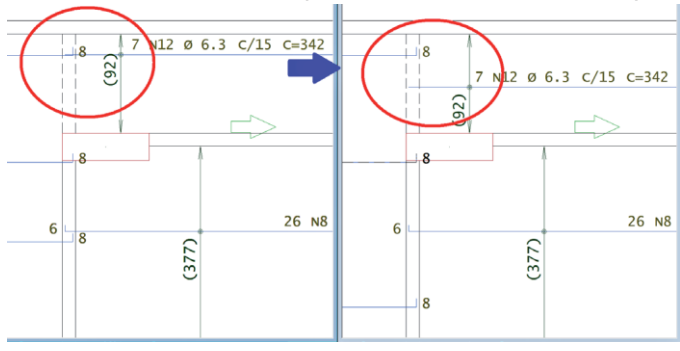
Negative bands on columns can be joined late and automatically, if they have continuity of alignment. This causes them to decrease the number of negative bands in contours that include column.



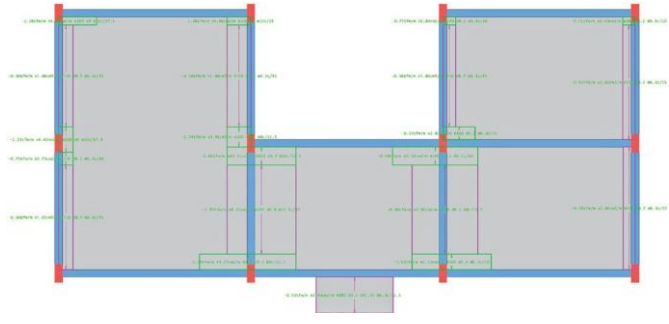
We rectified the contours of slabs passing through a section of the columns that often resulted in bands of variable length. With this, we obtained a simplification of the negative bands.



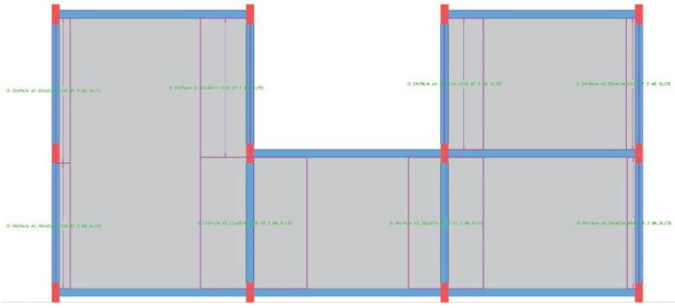
In the generation of positive reinforcements, interference checks were carried out and hard reinforcements were repositioned when necessary.



A common fact is a building with different floor plans, but of the same geometry. If negative bending bands are more interactive work, why not take advantage of the geometry of homogenized bands from one plant to another similar one? Let's say a floor plan with negative stripes in the middle of the building:



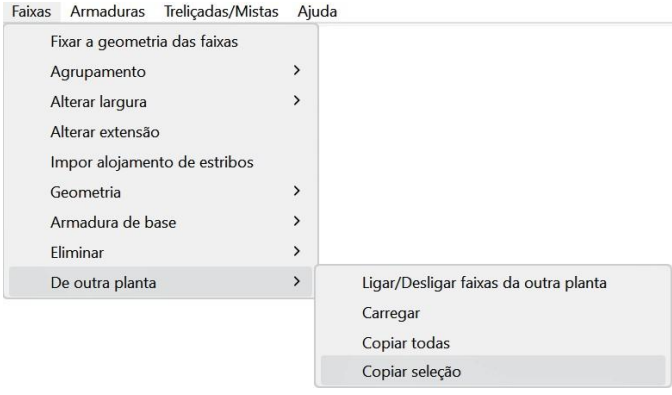
On the bottom plan, we can have negative bands that have already been homogenized:



The difference between one and the other is just a small, cantilevered slab. So, a system for copying was created with the following rules:

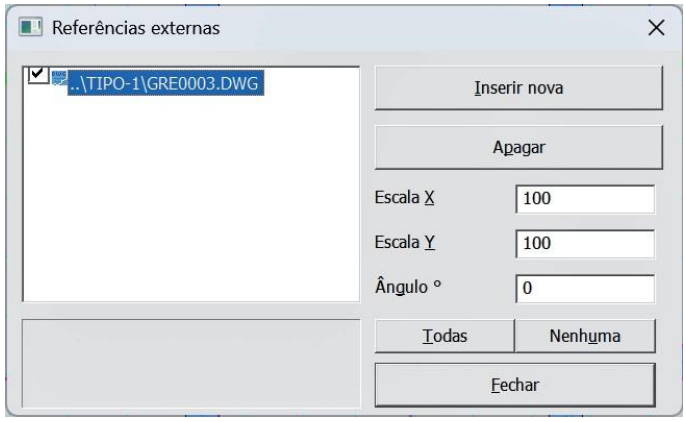
- Choose the floor plan and tracks to copy (or all).
- Tracks whose geometry is valid on the target plan can be copied and there is no other track in the same position.
- The forces on the target plant are recalculated for the copied tracks.

In this example, we would delete all negative tracks from the balance sheet, and trigger the copy of the bottom plan. Before copying, we can "load" the tracks of the other plant into the current plan, and check the positions in a different color.



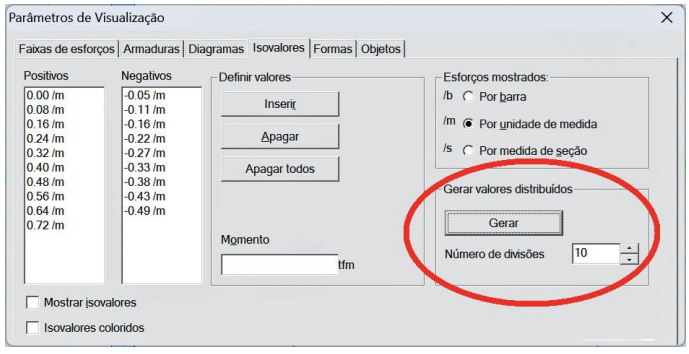
The activation of several viewing modes was facilitated, through a menu under the Ribbon:

To switch the isometric perspective mode, the <TAB> key is also accepted. The external references editing window has been redesigned, making it easier to insert that is interactive. In addition, external references automatically become part of the generated reinforcement drawings.

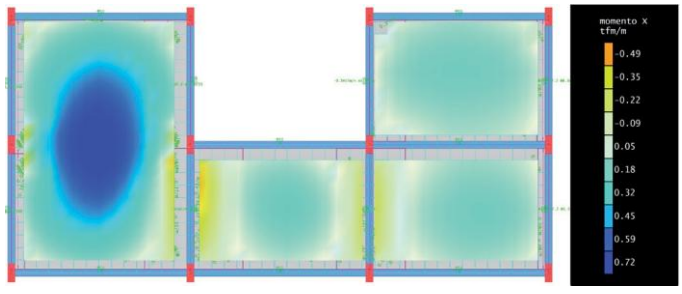


With the introduction of rib nullifiers in the modeler, interrupted bands are no longer grouped with continuous ones, and the anchoring of the interrupted reinforcements by the cancelers was corrected.

Positive and negative moment isovalues are now displayed together in the editor. And when fixed values of isovalue curves are not defined, the editor generates them automatically. The window for defining the curves to be shown also has this generation:



In addition to the isovalue modifications, a color map of bending moment isovalues in the X or Y directions can be shown for direct reference of forces in the ranges:



Completing Quick Reinforcement Editing, non-detailable holes are naturally no longer considered.

MANUAL DE BOAS PRÁTICAS Volume Único

Você já conhece o **Manual de Boas Práticas - Montagem das Armaduras de Estruturas de Concreto Armado - Volume Único**?

Este material reúne diretrizes essenciais para a montagem de armaduras em estruturas de concreto armado, integrando boas práticas, normas vigentes e observações de campo, com foco na qualidade da execução, no desempenho estrutural e na durabilidade ao longo da vida útil da estrutura.

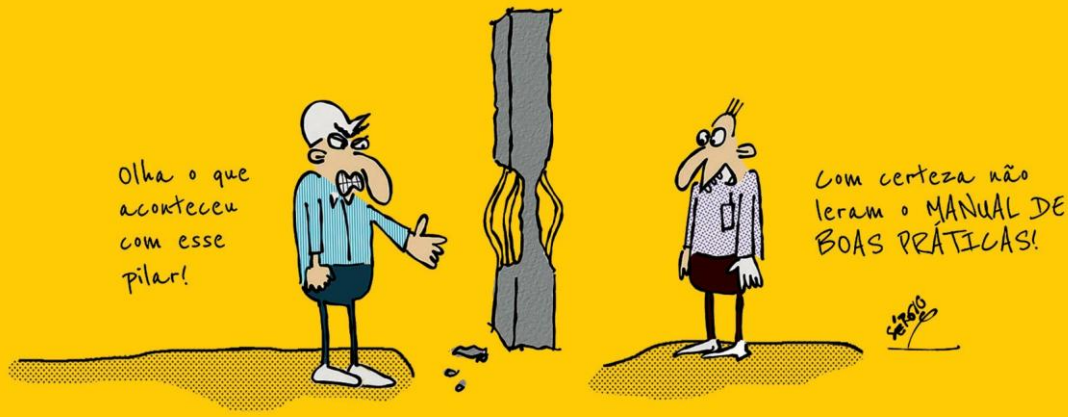
BAIXE O MANUAL GRATUITAMENTE!

O projeto é resultado do trabalho dos autores Jorge Nakajima (Satoro), Larissa Arakawa Martins e Mauricio Silveira Martins, com a realização das empresas França & Associados Projetos Estruturais e Gerdau, contando com o apoio da TQS Informática.

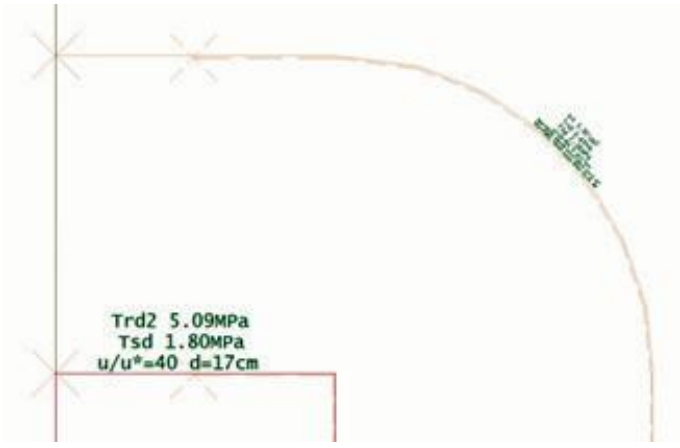
Realização:

FRANÇA & ASSOCIADOS
PROJETOS ESTRUTURAIS

GERDAU
O futuro se molda

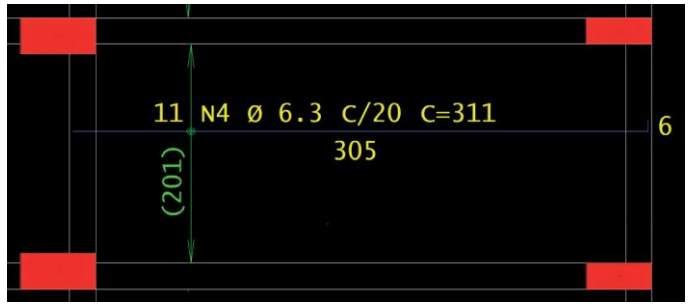


Complementing the changes, the presentation of reduced punch perimeters has also been improved. We now present all the calculation variables necessary for verification:



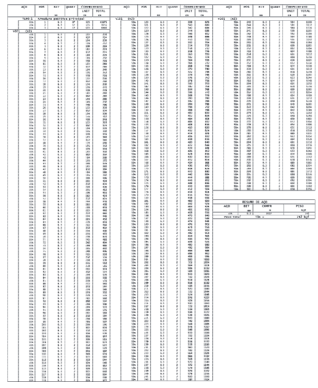
Smart Reinforcement

Certain interferences started to be solved directly by the smart iron library, affecting the slab system and others. For example, the stripe line is always moved to a range between texts, and the stripe length is moved if it interferes with the main text of the iron.



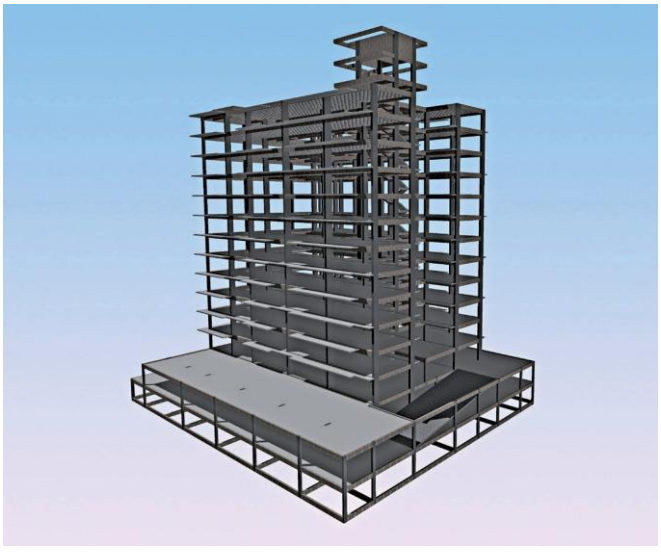
Floor plans Edit

The double iron table that divided the elements into two columns now analyzes whether there is enough space for an element with many positions – for example, slabs with 300 positions. The table can be automatically separated into columns in the middle of an element, and more than two columns can be generated, allowing repositioning to fit the plan.

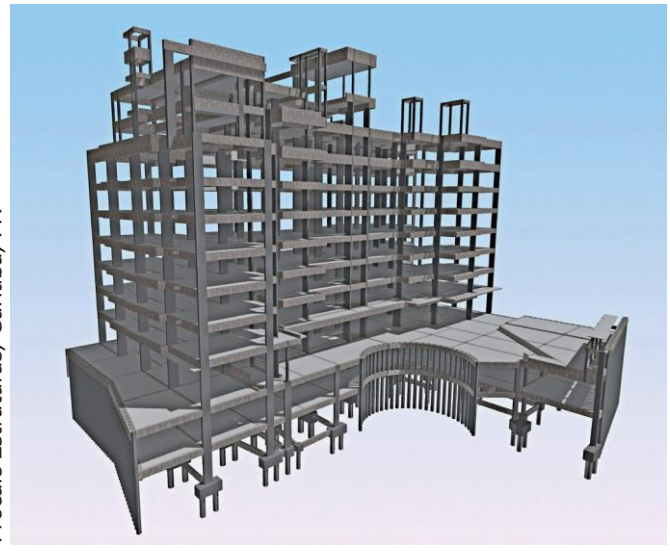


Light Solver

Improvements in calculation methods have allowed for improved processing time for large models. The decrease in processing time reaches 45% of the time spent, when compared to V26.



PROJECTIV Engenharia, João Pessoa, PB



Procalc Estruturas, Curitiba, PR

Discretized Shear Wall

New criterion that allows you to control the existence or not of the crossbar at the base of the discretized bid. With this criterion enabled, the overlap of the top and bottom crossbar of two throws no longer exists.

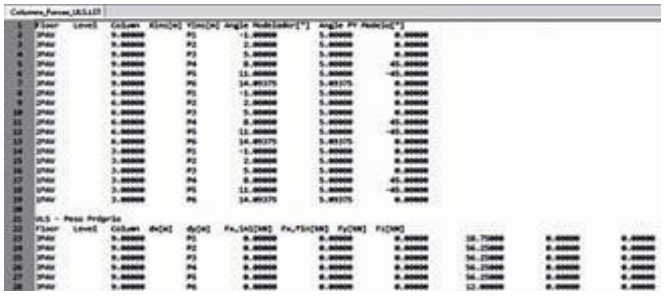
Connected towers and wind tunnel

In some architectural cases, we currently have the characteristic of having two towers of the same development connected to each other, on some floors. Depending on the connection between the connection and the towers, they can work in ways that are not expected to be used by wind. That is why it is important to use a wind tunnel in these cases.

For these cases, where it is necessary to define the wind load of the tunnel for two or more towers of the same building with a rigid diaphragm on the slabs, a program is being created to facilitate the reading of the data and definition of the wind loads. A working version of the program is already being tested and has made it much easier to enter customer data.

Forces/Displacements by column span

List and spreadsheet with the efforts and displacement of all column bids. Information on the geometry of the column is also presented.



	A	B	C	D	E	F	G	H	I
1	Floor	Level	Column	dx[m]	dy[m]	Fx,ini[kN]	Fx,fin[kN]	Fy[kN]	Fz[kN]
2	3PAV	9,00	P1	0,04	0,04	10,00	10,00	-10,00	10,00
3	3PAV	9,00	P2	0,02	0,00	20,00	20,00	-20,00	20,00
4	3PAV	9,00	P3	0,00	0,04	30,00	30,00	-30,00	30,00
5	3PAV	9,00	P4	0,01	0,01	40,00	40,00	-56,57	0,00
6	3PAV	9,00	P5	0,06	0,06	50,00	50,00	0,00	70,71
7	3PAV	9,00	P6	0,40	0,40	60,00	60,00	-84,85	0,00
8	2PAV	6,00	P1	0,02	0,02	20,00	20,00	-20,00	20,00
9	2PAV	6,00	P2	0,01	0,00	40,00	40,00	-40,00	40,00
10	2PAV	6,00	P3	0,00	0,02	60,00	60,00	-60,00	60,00
11	2PAV	6,00	P4	0,00	0,00	80,00	80,00	-113,14	0,00
12	2PAV	6,00	P5	0,03	0,03	100,00	100,00	0,00	141,42
13	2PAV	6,00	P6	0,21	0,21	60,00	60,00	-84,85	0,00
14	1PAV	3,00	P1	0,01	0,01	30,00	30,00	-30,00	30,00
15	1PAV	3,00	P2	0,00	0,00	60,00	60,00	-60,00	60,00
16	1PAV	3,00	P3	0,00	0,01	90,00	90,00	-90,00	90,00
17	1PAV	3,00	P4	0,00	0,00	120,00	120,00	-169,71	0,00
18	1PAV	3,00	P5	0,01	0,01	150,00	150,00	0,00	212,13
19	1PAV	3,00	P6	0,06	0,06	60,00	60,00	-84,85	0,00
20									

Geometry | Peso Próprio | **Cargas permanentes** | Cargas acidentais

Columns

An evolution for the editing of the housing of reinforcement in column flights is in the research phase. Currently, the workflow often involves the preliminary choice of gauges in the Lispil file, a selection of arrangements by the "Gauges / Reinforcement Area" program and the verification of forces within the quick editing of reinforcement with possible adjustments on a pitch-by-run basis, an often-fragmented process.

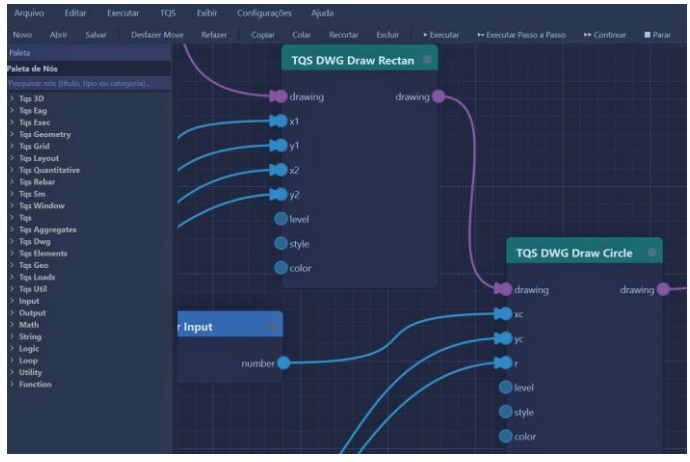
With this in mind, we are working to integrate these steps so that the editing of the accommodation in column flights becomes more agile and visual. The idea consists of a complete visualization of the plumbline, with batch editing of bids and verification of efforts in the same window.

Viewers

The dynamics viewer will be incorporated into the gantry and grid viewer, centralizing the visualization of the results in a single program. The *Time-History* analysis, in turn, will be separated from the current viewer and will have an exclusive program.

Visual programming

What if you could automate repetitive tasks in TQS without writing a single line of code? A new visual block programming tool is being developed – inspired by tools such as *n8n* and *Grasshopper* – that allows structural engineers to create complete workflows by simply dragging, connecting, and configuring nodes. Each node represents an operation: opening a building, iterating floors, extracting quantities, generating drawings or even performing global TQS processing. The result is a visual diagram that replaces *traditional scripts, drastically reducing the learning curve and automation development time* .



At the heart of this tool is the concept of a node: a visual block with entrances on the left and exits on the right. Connections connect outputs to inputs, forming the flow of data. The system currently has more than 200 nodes distributed in 25 categories, covering everything from mathematical operations and string manipulation to integration with the 14 modules of the TQS Python API. The *sockets* are colored by data type – numbers, texts, booleans, vectors, dictionaries, and objects, which makes it visually intuitive to identify compatibilities between blocks. The Properties panel allows you to configure each node without touching code:

Just select the block and adjust the parameters. Several categories offer the foundation of structured and object-based programming, while TQS categories give full access to the TQS-Python ecosystem.

Integration with the TQS API follows a natural hierarchy that mirrors the organization of the structural project. A typical flow starts with the TQS open *building node* to open the project, followed by TQS *open model* to access the structural model. From there, we have the list of floors, and the iteration through each floor, obtaining beams, columns, slabs, foundations and other objects with the specific nodes of each type. For each element it is possible to visually extract the geometry and properties. See in the following figure, the compact flow that opens the building, accesses the model and automatically generates a consolidated quantitative report, exporting the result in JSON. More advanced operations include generation of DWG drawings, creation of drawings, geometric calculations (distances, angles, intersections, areas), global processing and manipulation of 3D models. For scenarios that require communication with running TQS, the IPC *bridge* system offers real-time, bi-directional integration.

One of the innovative features of this new tool for programming is the ability to convert the blocks of nodes into executable Python code and vice -
-versa. In addition to producing complete programs, it can
It is used as a tool to start a Python project or an ongoing project, to visualize, debug and fix Python programs.

Other implementations – Python

- Beginning of implementation of structured Python protocol. To make better use of the *Intelli-sense capability* of IDEs, and to make it easier for AIs to understand the passing of variables.
- New routines for controlling the position of straight iron texts, and other fixes.

Interface with BPIc

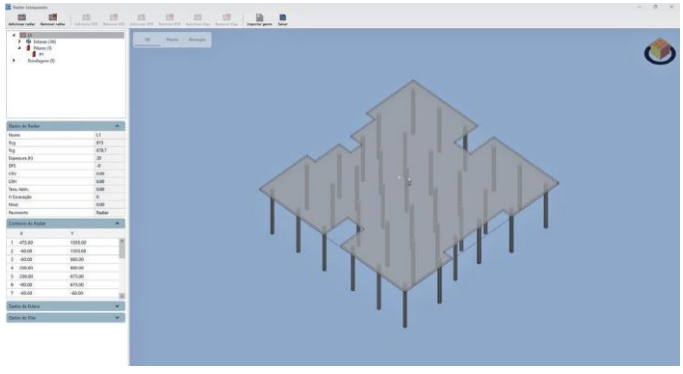
BPIc is the *interactive benchmark for low-carbon projects.* It is a platform developed by Caixa in partnership with USP, launched in November 2025 to measure and reduce carbon emissions in housing projects. The tool is used to analyze the environmental impact of materials and construction methods, encouraging sustainable civil construction and often reducing production costs.

In partnership with professors Vanderley John and Lucas Melchiori Pereira from USP, TQS has developed an interface that will link, at the initiative of the engineer, in real time, the quantities of projects with the BPIc databases.

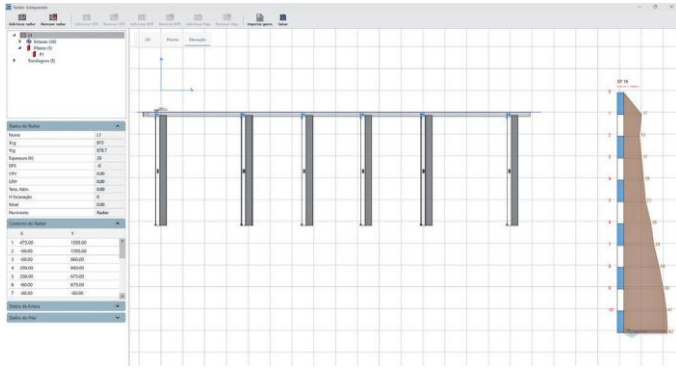
Sises Editors

The foundation editors of SISES have been redesigned. There are nine editors in all: Isolated footings, Associated footings, Blocks on pipes, Circular pipes, Circular piles, Barrette piles, Radier, Piled radier and Beams between elements. Radier and staked Radier, which were previously separate programs, have been unified.

The main novelty is the 3D visualization integrated into each editor. You can freely switch between three modes (3D, Plan, and Elevation) via tabs in the drawing area. In the 3D view, foundation blocks, piles, pipes, and columns are rendered with different materials and colors. The selection is bidirectional: clicking on an object in the 3D scene selects the corresponding element in the data tree, and vice versa. We also have the option of isolating a specific element, making it easier to check projects with many foundations.



All nine editors now share the same *layout*: side panel with retractable sections (identification, geometry, discretization, design criteria, and surveys), hierarchical tree organizing elements by type (blocks, stakes, columns, beams), drawing area with alternating views, and command bar at the top. Editing properties is done directly in the dashboard, with immediate updating in the view. Anyone who learns to operate a do-mine editor the mechanics of all the others.



Integration with the building model has been maintained and improved: columns and floors are automatically read from the project, and foundation elements are filtered by level. Editors now support multi-selection and multi-assignment. For example, you can select multiple stations and change their properties at once. Batch operations such as column association, geometry import, and copying data between blocks are available through dedicated dialogs in each editor.

AI

Developing a feature that really makes a difference takes time. Over almost two years of research and development, we explored different paths, tested different technological approaches and evaluated their practical applications in varied scenarios. This path made it clear that the quality of the data and the way AI is applied require extreme care that does not accept improvisation. We listen to our clients and prioritize what is really useful for the calculation office, escaping the trap of using artificial intelligence just because it is the trend of the moment. It was this careful, down-to-earth process that led us to a technological solution in which we placed genuine technical trust.

There's a question that every calculator has asked himself or herself at some point in the project: "Is this really the most efficient solution, or just the first one that worked?" Answering this question rigorously has always required time that timelines rarely allow. It is precisely this gap that one of our most ambitious projects seeks to fill. Combining the most advanced international scientific literature with the computational capacity available today, we are developing a resource that will bring to the *software* an unprecedented character of guidance and *feedback* to the designer. The result is a tool that does not replace the engineer's judgment: it elevates him. The full details will be revealed soon, but we can say that upon seeing it in operation, the most common reaction among our engineers has been one: "Why didn't that exist before?"

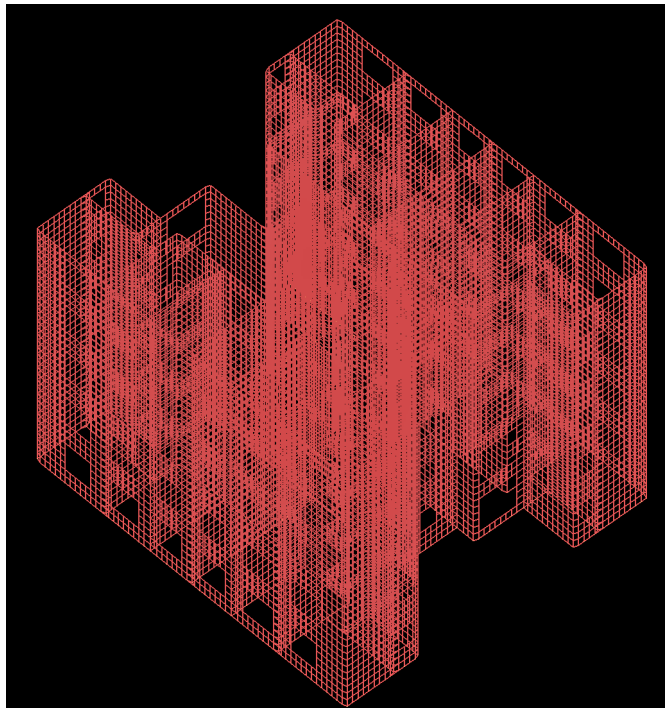
Internally, AI is also already changing the way we take care of our customers. We are gradually building a knowledge base fed by our own accumulated experience, so that each service is more agile and more useful than the previous one.

Alvest

Modeling

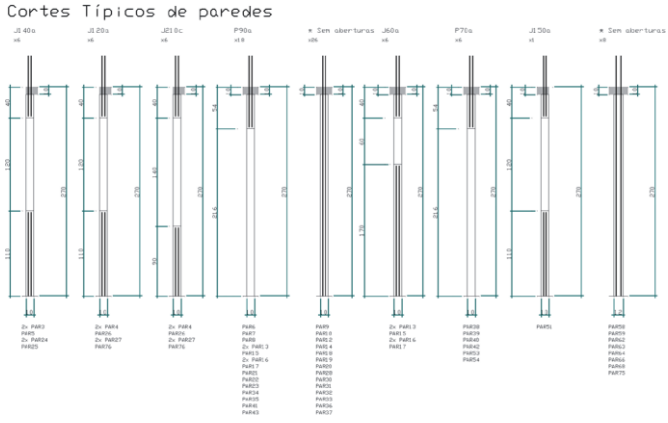
The possibility of modeling the walls via bar mesh is being studied.

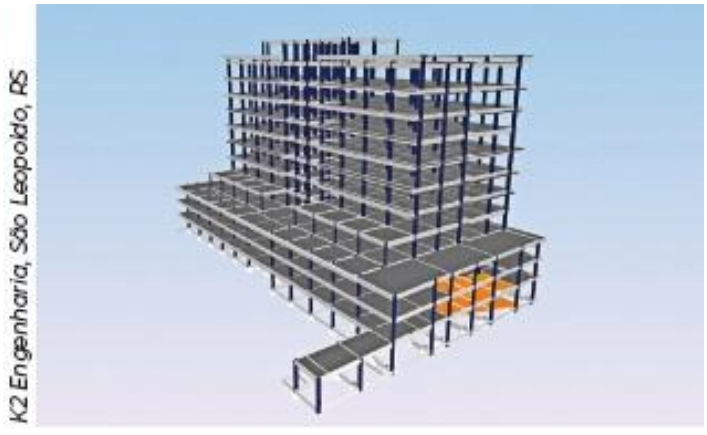
This modeling has the potential to improve/refine the analysis of the descent of vertical loads, interaction between structural masonry and load-bearing structure of reinforced concrete, possibility of introduction of reinforced concrete beams on the masonry pavement, among others.



Elevations

Possibility to remove the representative cut from the walls, and to create a drawing with all the typical cuts (of the openings) of the plan, separately.

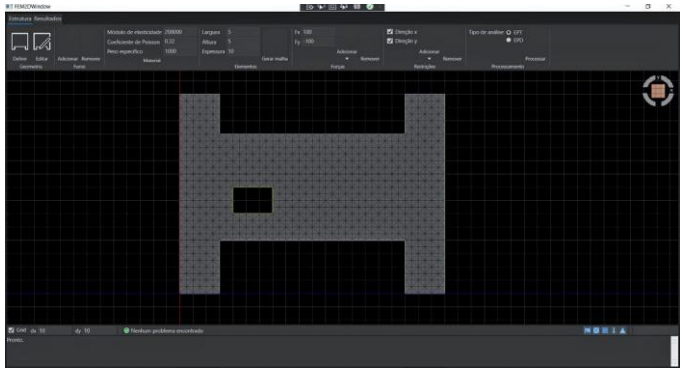




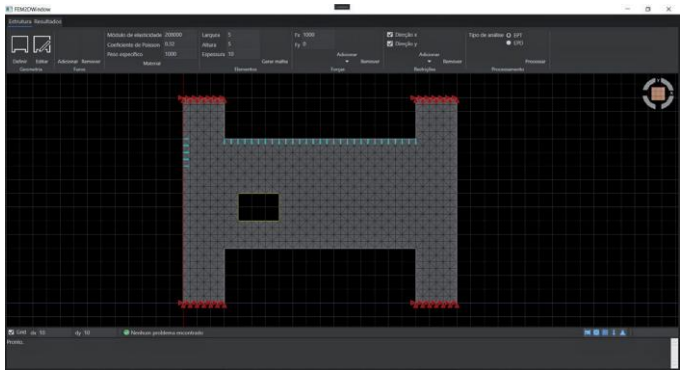
K2 Engenharia, São Leopoldo, RS

FEM/Plate Calculator

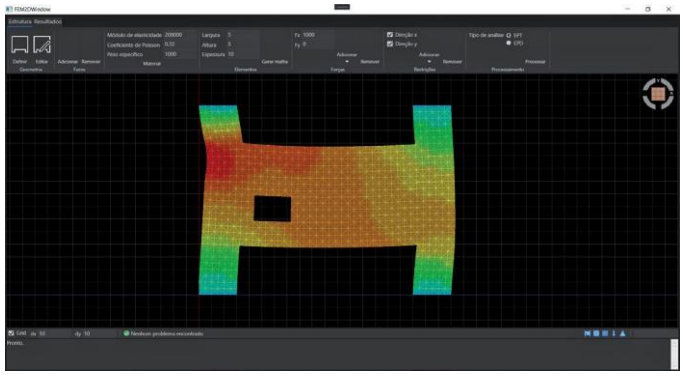
The Sheet Calculator will be a separate program in which it will be possible to model and analyze sheet metal elements through the two-dimensional finite element method. In it, it will be possible to graphically define the geometry of the elements, including the addition of holes, with which a three-node triangular finite element mesh (T3) will be automatically generated, from the definition of their dimensions.



After the mesh is generated, it will be possible to add nodal forces and constraints separately or through polygonal, simultaneously encompassing several nodes.



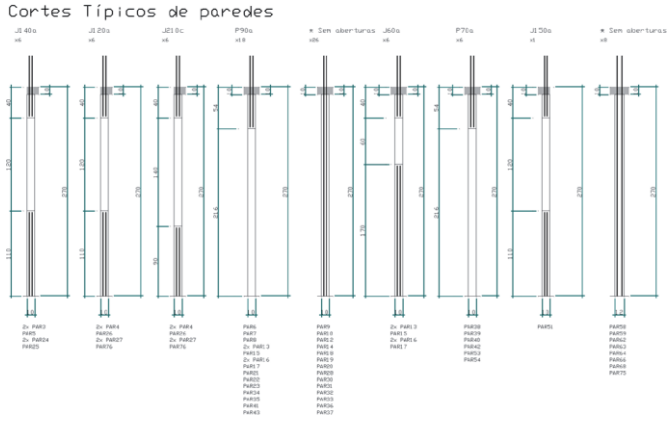
Once geometry, loads, constraints and material properties have been defined, it will be possible to perform the analysis via FEM considering Plane State of Stresses (EPT) or Plane State of Deformations (EPD). The results will be presented graphically through color gradients, with the visualization of displacements, deformations, stresses and main directions of stresses in the elements.



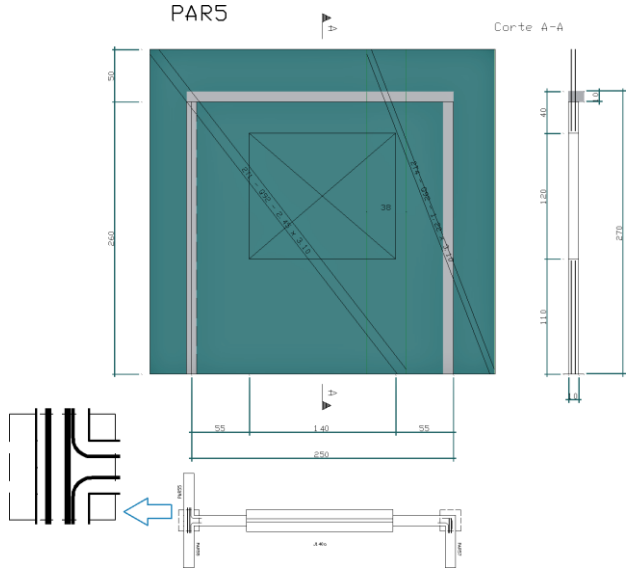
Concrete Walls

Elevations

Possibility to remove the representative cut from the walls, and to create a drawing with all the typical cuts (of the openings) of the plan, separately.



New option for wall crossings, with screen doubles at the ends / crossings, allowing greater economy, agility and fewer cuts. Possibility of simplified representation of the intersections (in the plan representation, in the elevation), the screens that follow, the straight ends and those that bend.



BIM

We are working on a significant update for the import of IFC files, and the preliminary results are very encouraging.

We are developing an optimization in the import algorithm that has the potential to reduce the reading time of IFC files by up to 90%. This means that a process that previously took, for example, a few minutes, will now be completed in just a few seconds. Same files, same quality with much less waiting.

In addition to the speed gain, we have completely revised the algorithm responsible for displaying the

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solids generated from IFCs. Previously, the model displayed edges in all triangles of the triangulated mesh, which resulted in a loaded and barely readable view. With the new calculation, only the relevant areas are displayed. The result is a much cleaner, more faithful and pleasant geometry to work with.

Other

Mathematical expressions

The system's numerical fields now accept mathematical expressions directly. Instead of calculating the value externally and typing it into the field, the engineer can write the expression – such as 5600*sqrt(30) or pi*25^2/4 – and the system evaluates the result automatically when confirming the input.

The following are supported: basic operations, potentiation, parentheses, trigonometric functions (sin, cos, tan, and their inverses), square root, logarithms, and constants such as π. The feature is available in any numeric text box in the system.

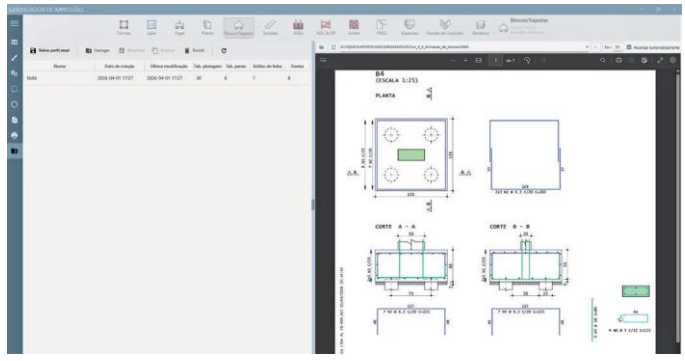
Print Manager

The Print Manager (NGPP) has undergone a redesign of its screens, with a focus on performance and organization. The configuration sections – plotting, feathers, fonts, styles, hatches, circles and PDF settings – have been restructured so that navigation between them is more fluid and the program responds more quickly.

The most significant novelty is the introduction of profiles. A profile brings together all the plot configuration—color and weight, line styles, fonts, hatches, and plot tables—into a single file that can be saved and shared. In practice, the engineer in charge can define the default office configuration, export it as a profile, and distribute it to other users, who apply it to their computers with one click.

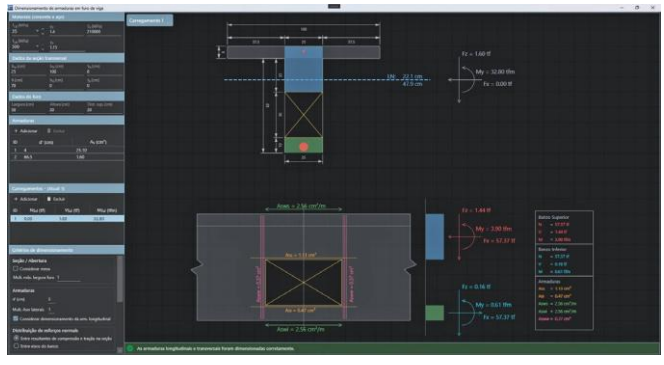
The process is fully reversible: before any load, the system automatically creates a *backup* of the current configuration, allowing you to restore the at any time.

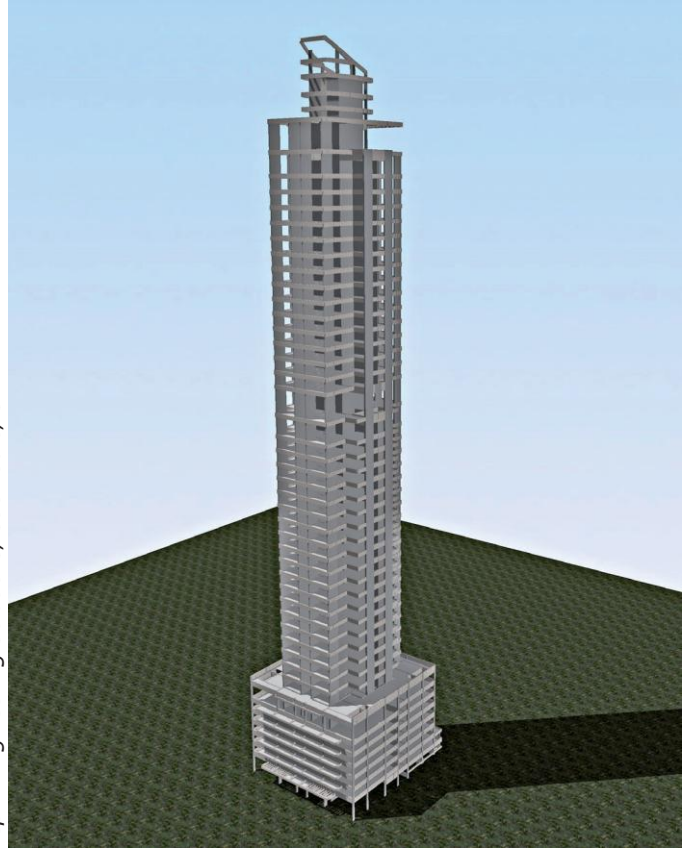
Another practical improvement: it is now possible to open the analyzed design directly in the Graphical Editor (EAG) to manually check the levels used. The program now also keeps a history of the drawings accessed, making it easy to quickly switch between one drawing and another without having to navigate through the file picker folders again.



Dark mode

Several programs in the system started to respect the color arrangement configured in the Manager's criteria, in the Interface Ribbon section. When you select a dark color arrangement, programs such as the Oblique Compound Bending Calculator, the Print Manager, the Drawing Catalog, the Deflection Analysis Viewer, the Crack Opening Calculator, the Reinforcement Editor for Integrating Cracks, the Beam Hole Calculator, the Parametric Object Editor, the Plot Manager, and the Column Data Editor already start automatically at dark mode, adapting backgrounds, texts, and visual elements to the chosen theme, with the aim of offering a consistent visual experience.





Zeplin Engineering Solutions, São Paulo, SP

New version V26
Even more complete and definitive!

TQS has the features I need to design with quality and productivity. It really is a complete tool.

For decades, I've been using TQS to design structures that shape the cities where we live. It really is a definitive software.

Would it be possible to make TQS even more complete and definitive?

The new features of the V26 version make TQS even more complete and definitive.

Viewport

Innovative. Minimizes rework in project revisions. Add more value to your floor plans by including 3D details.

Shear Walls

Much faster. New group of stripes can generate a more economical reinforcement design.

Other elements

Major improvements to the Quick Beam Editor. New 3D curve. New Load Plant.

Technical standards

Revisitation required. New NBR 8800:2024 in MetalCheck.

Graphic Editor

More assertiveness in the execution of commands. Accurately sized texts. New Drawing Catalog, with Project Notes.

Structural analysis

Viewer with simultaneous moments and fewer texts. EPP and EPP3 packages with dynamic analysis and faster nonlinear grid.

Other systems

New features in MetalCheck, Alvest, Sises, VPRO and Concrete Walls. 3D Prestressed Slabs.

And much more...

News in BIM, AI, Python, etc.

Find out all the news of the V26 version, with details, below.

Viewport

Unprecedented features to improve documentation, avoid rework, and enter 3D details

We know that the elaboration of a structural project is not a perfect sequential process. Design reviews are frequent in the daily lives of engineers. In this scenario, when it is necessary to regenerate a previously edited design, information may be lost and/or need to be readjusted. It generates work. Generates cost.

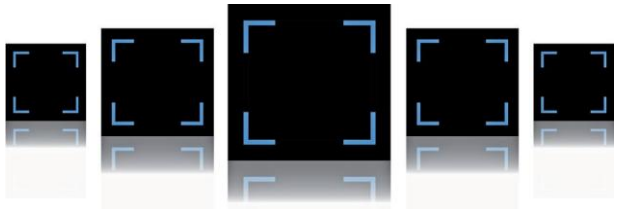
A change would be very welcome

With this in mind, we created a new feature, called Viewport, which allows the user to add edits in an extra layer that are not lost when a drawing is automatically regenerated. Conceptually, Viewport is very simple. But, as it is a disruptive alternative, it may require a small change in the way of preparing the final drawings.

A disruptive change, but with benefits

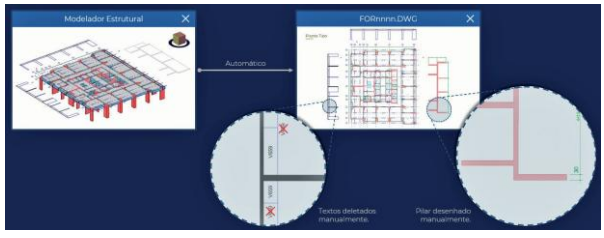
We know that the elaboration of a structural project is far from being a linear process. Revisions are part of the routine of engineers and, in this context, the need to regenerate previously edited drawings is quite common. When this happens, information can be lost or require new adjustments

resulting in rework, increased costs and reduced productivity.

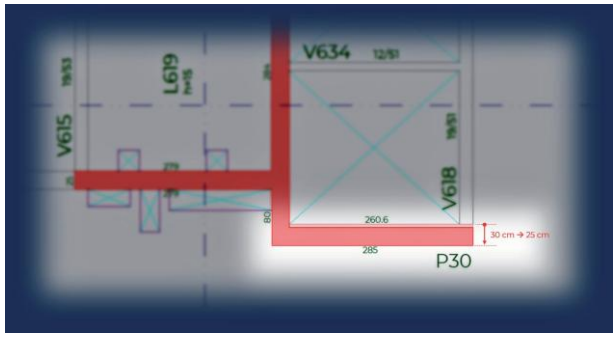


The beginning of a great change...

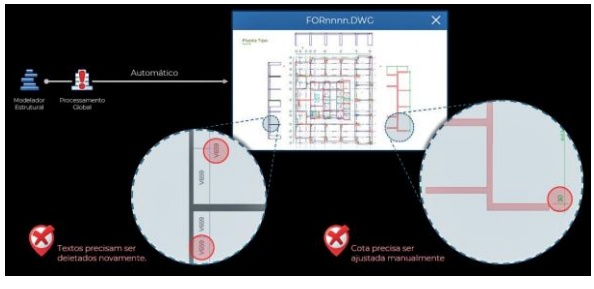
The following is a simple example of using the Viewport in a process that involves reviewing a formwork plan. Given a floor released in the Structural Modeler (with an elevator column next to it in a reference drawing), we will generate the formwork automatically by TQS (FORnnnn.DWG). Then, manually, we will delete two re-sundant texts in one of the cuts.



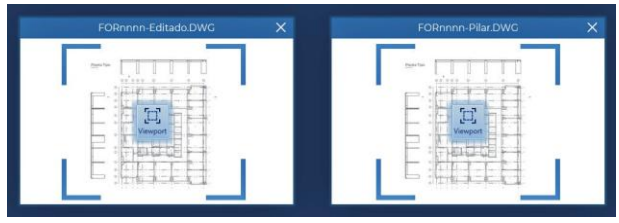
After issuing this plan, imagine that the thickness of one of the walls of the elevator column must be changed. The need arises, then, to create a project review.



Initially, thinking about the process as it is today, that is, without Viewport, we would make the adjustment in the Structural Modeler and reprocess the building. But what about the design of the formwork plant? The two previous edits – texts of the deleted cuts and the elevator column drawn on the side – would have to be manually reviewed and/or adjusted.



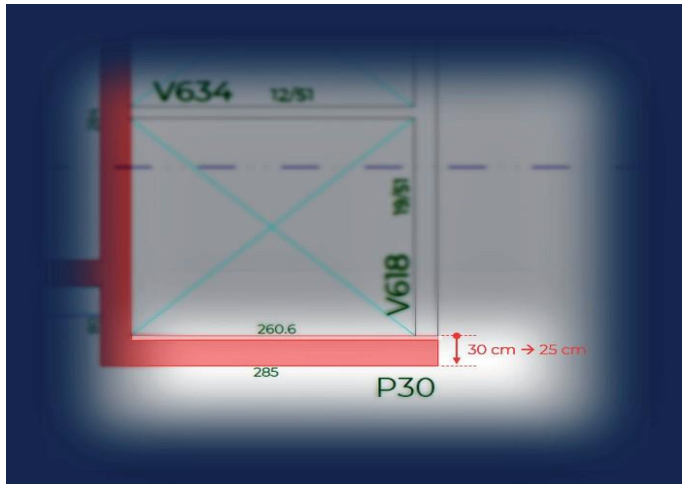
Now, let's illustrate what that same process would look like with the new Viewport. First, let's create two drawings (FORnnnn-Editado.DWG and FORnnnn--Pilar.DWG) and add a Viewport to each of them, both referencing the TQS-automatically generated formwork design (FORnnnn.DWG).



At first glance, Viewports look like blocks of designs. The difference, however, is that they are editable on an extra layer. In the Viewport of the first design (FORnnnn-Editado.DWG), you can include polygons that eliminate redundant text from cuts. In the Viewport of the other drawing (FORnnnn-Pilar.DWG), we'll create a traverse that excludes what's around the elevator column.

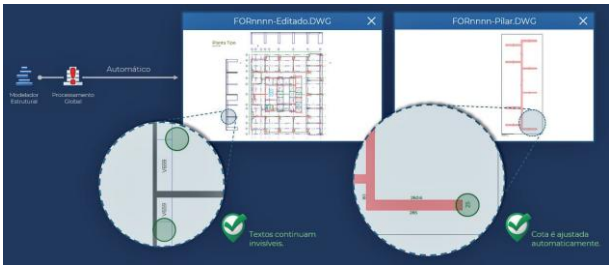
With this, both drawings are ready to be issued in a plan. Until then, the initial result (before the need for the design review) is identical to the process we currently use.

But what about when it is necessary to change the thickness of one of the walls of the elevator column? What changes in design review with Viewport?



This is where the magic happens

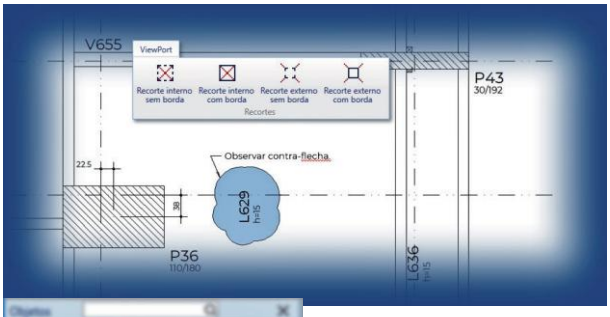
When regenerating the TQS drawing (FORnnnn.DWG) with the change made in the Structural Modeler, both Viewport drawings (FORnnnn-Editado.DWG and FORnnnn-Pilar.DWG) will be automatically updated, and the best thing is that they will not lose the edits in the extra box (where we had inserted the clipping polygons). Thus, no editing will be required to issue the design review.



This example demonstrated some of the potential of Viewport. A paradigm shift. A possibility to make frequent design reviews less costly. But that doesn't end here. Get to know some more features of Viewport below and be surprised by how it works in 3D.

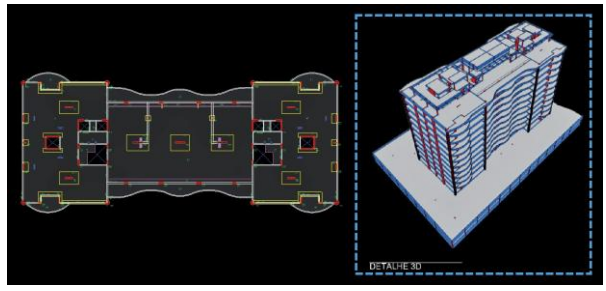
Attributes and annotations

Control the scale, add title, border, etc. to the Viewport properties. In addition to the crop polygons, you can add text, lines, and other graphic elements to the extra Viewport layer.



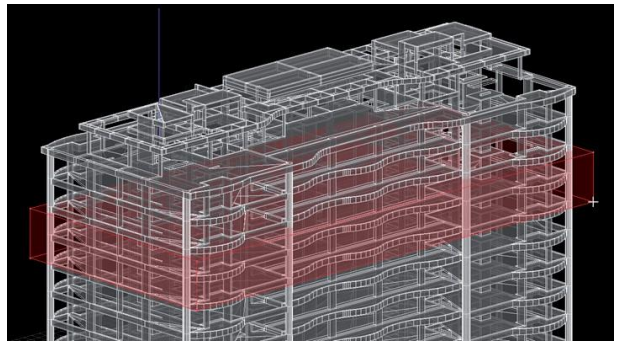
In addition to working with 2D drawings, Viewport also works in 3D. The logic is very similar; we can insert a 3D drawing as a Viewport.

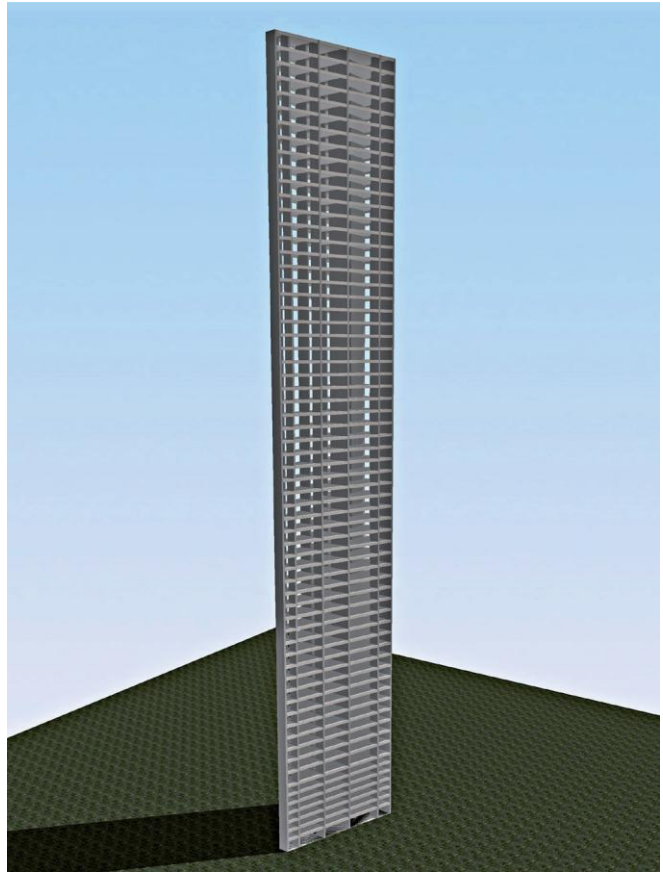
And this brings a possibility that didn't exist before: putting a 3D inside a DWG.



Double-clicking will open the 3D object editor (EAG3D).

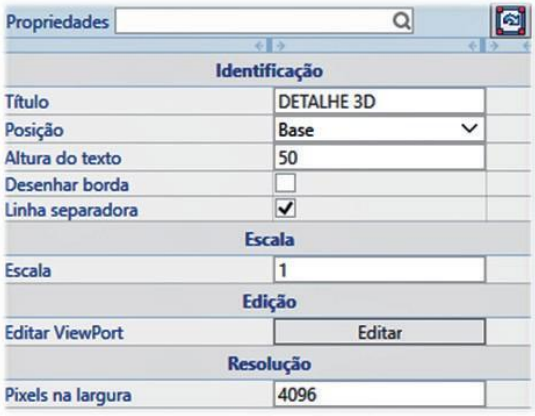
It is possible to isolate the viewing volume and the camera position.



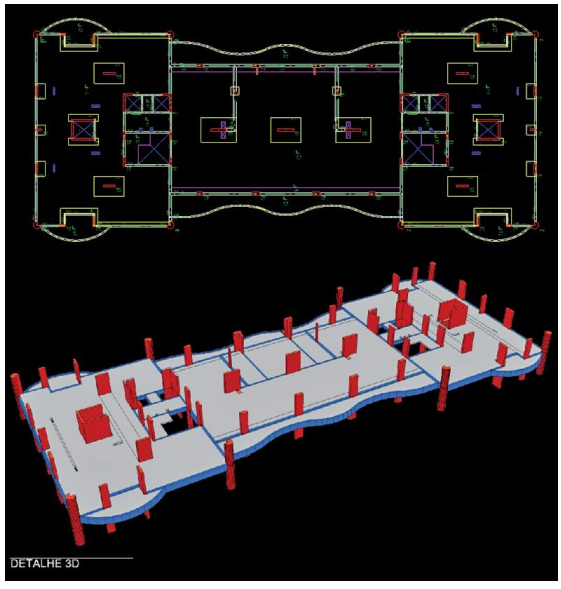


SOMMA Cálculo Estrutural, Campinas, SP

On insertion, it is possible to adjust the scale, identification and other attributes.



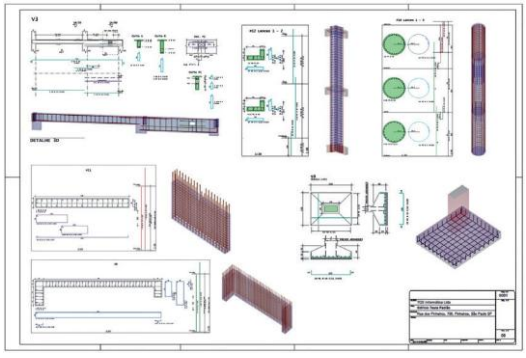
The following is an example of a 3D detail of the pavement next to the shape drawing.



Automatic 3D details

We have seen more armor designs with 3D details on the side. With Viewport, this is possible. Simply insert a 3D Viewport and isolate the structural element.

To speed up this process, we have created commands to automatically insert these 3D details into beams, columns, and foundations, which are compatible with PDF plotting.

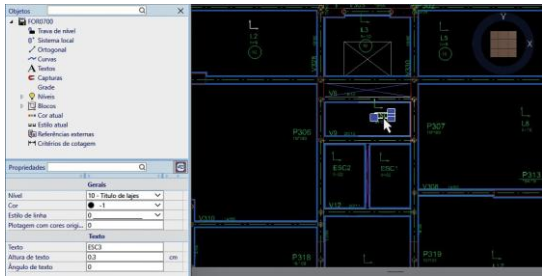


Graphic Editor

Several new features to improve productivity and assertiveness in drawing editing

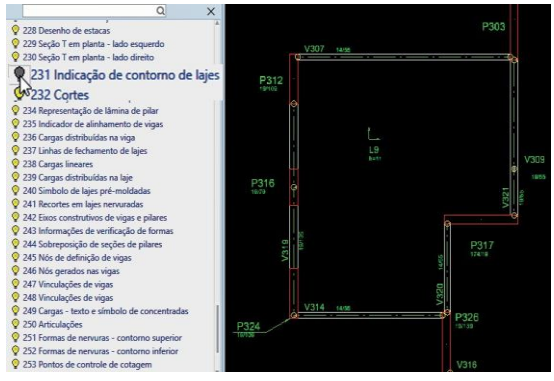
Side window

The side window with object tree and property table is now present in the Basic Drawing Editor.

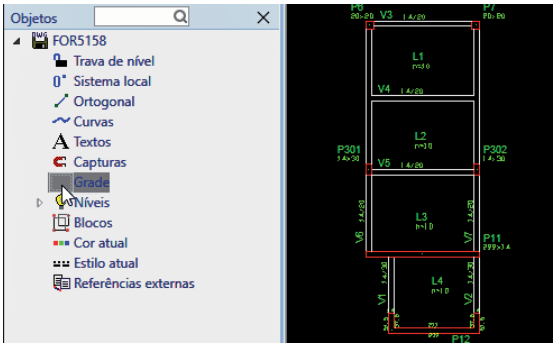


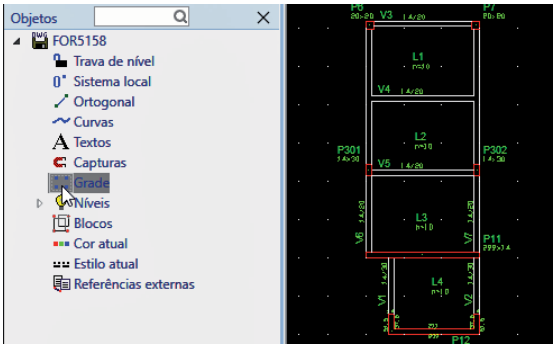
DWG global data organized in the tree: levels, capture, grid, blocks, and more.

Some items in the tree react to the click. Click to turn on/off a level.

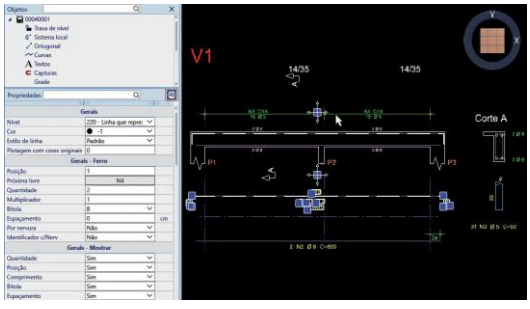


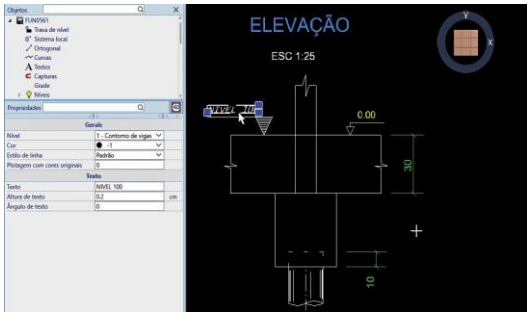
It is also possible to turn on/off capture, grid, orthogonal and more.

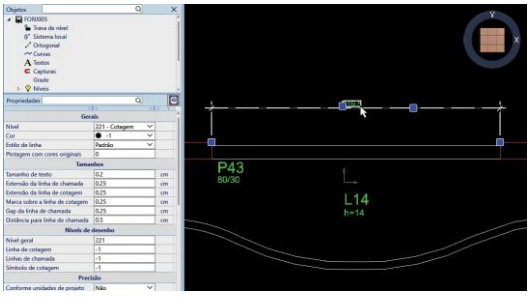




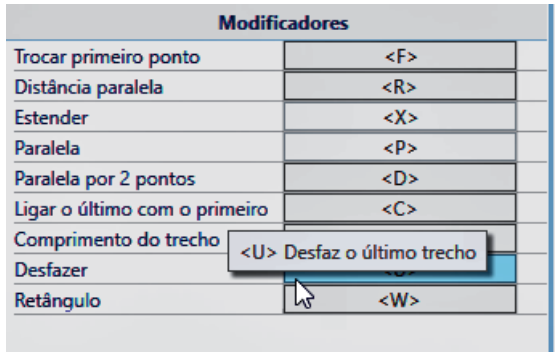
In the property table, edit level, color, and style for any graphic. For texts, height and angle. For smart objects such as dimension and reinforcement, edit all data. A significant productivity gain for editing one or multiple selected objects.





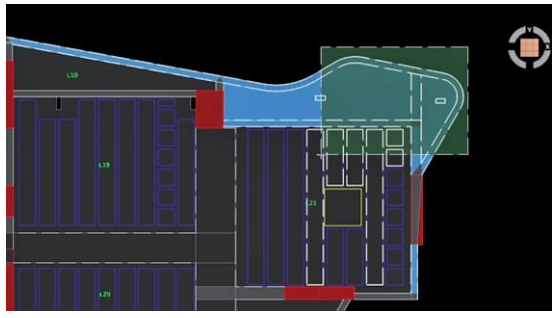


During command execution, the property table is used to list all modifiers. More visibility and explanations.



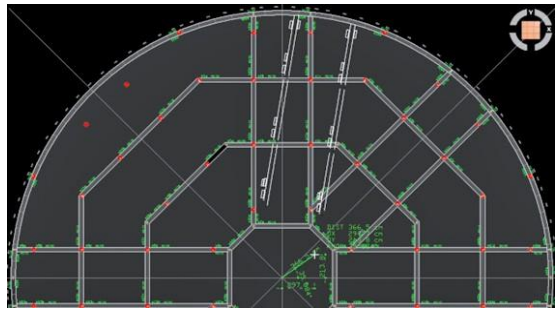
Dynamic selection

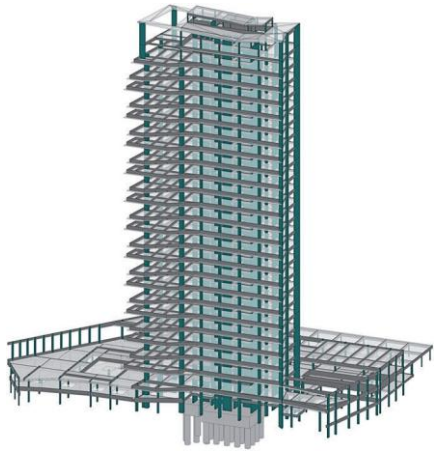
During a selection, the captured elements glow with the movement of the mouse.



Preview

In rotation, mirroring, partial move, cuts, and other commands, there is a preview during execution.





BEDE Engenharia, Belo Horizonte, MG

Angular Dimensions

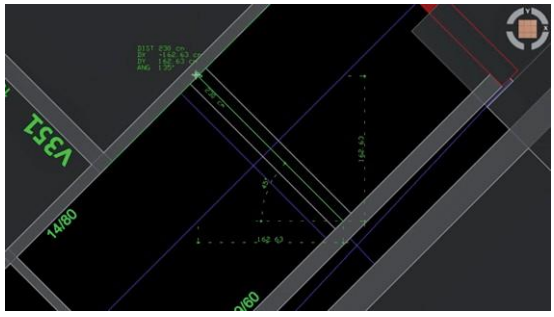
Angular dimensions are now associative. In editing with grips, format and value are automatically updated.

Local system

New command allows you to work with the rotated window. Useful for tilted models in plan.

Orthogonal capture

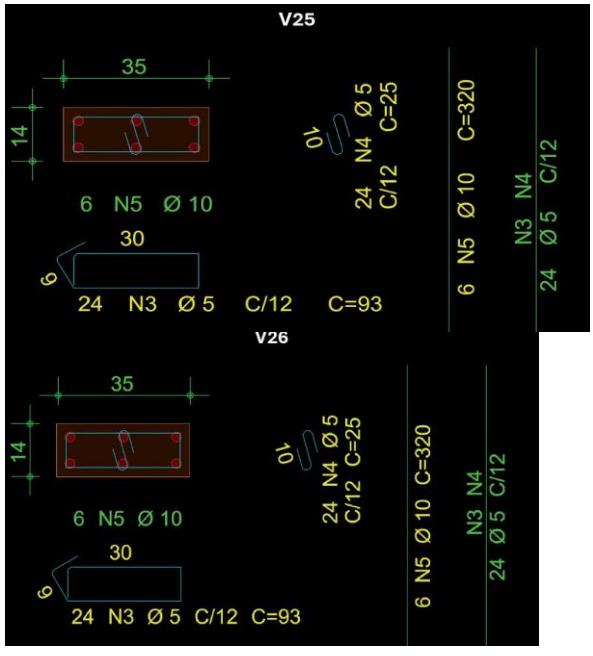
New point capture perpendicular to a line.



Text sizes

The calculation of text size has been improved, and we can now work accurately.

More control to align and position texts. In the reinforcement drawings, note the regularity in the spacing between texts. This directly impacts the quality of reinforcement designs.



The placement of texts in tables is another example.

V25

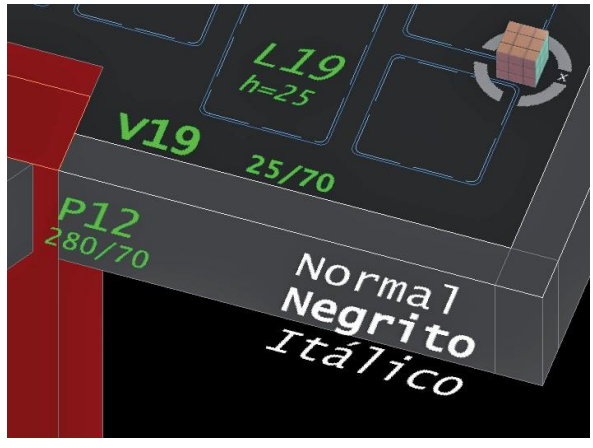
AÇO	POS	BIT	QUANT	COMPRIMENTO	
				UNIT	TOTAL
		mm		cm	cm
P1 Lances 1 - 3					
50A	1	10	6	355	2130
50A	2	10	6	81	486
60B	3	5	78	93	7254
60B	4	5	78	25	1950
50A	5	10	6	320	1920
50A	6	10	6	278	1668
60B	7	5	3	89	267

V26

AÇO	POS	BIT	QUANT	COMPRIMENTO	
				UNIT	TOTAL
		mm		cm	cm
P1 Lances 1 - 3					
50A	1	10	6	355	2130
50A	2	10	6	81	486
60B	3	5	78	93	7254
60B	4	5	78	25	1950
50A	5	10	6	320	1920
50A	6	10	6	278	1668
60B	7	5	3	89	267

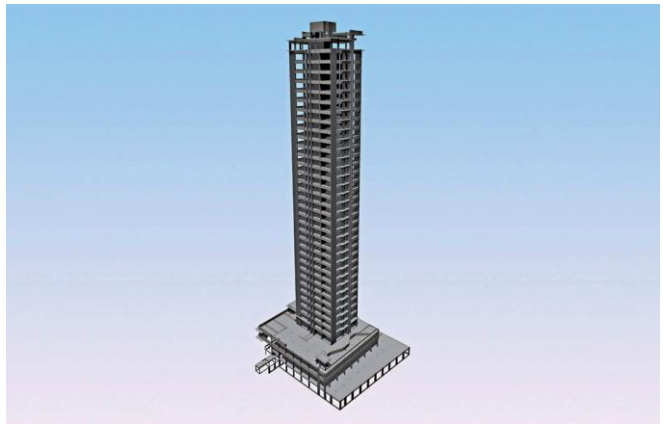
Text styles

Texts with bold and *italic* fonts are now also supported in a 3D environment.



Images

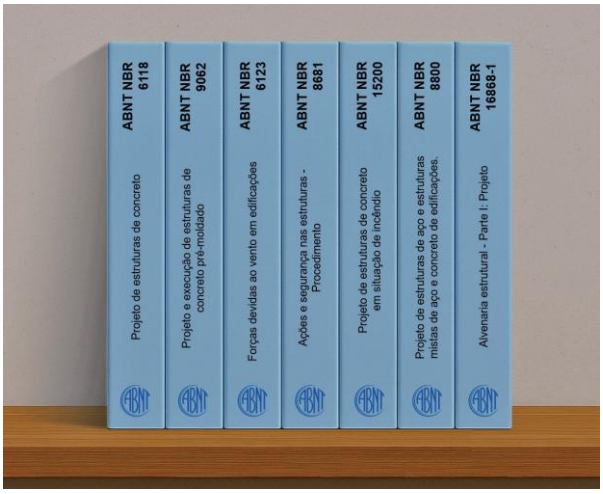
The Graphics Editor now supports images in PNG format. In addition, it is now possible to insert the image as a reference or embed it in DWG.



MBUIATE Engenharia de Estruturas, Uberlândia, MG

Technical standards

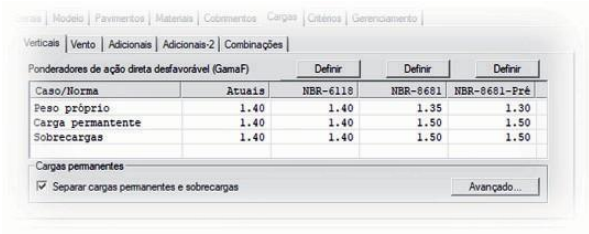
Attention to regulatory revisions



NBR 8681

The recently published mother standard for actions and safety has specific differences in relation to NBR 6118 which refers to the weights of the charges in the Ultimate Limit State (ULS).

In Building Data, options have been created to facilitate the definition of these weights.



NBR 6118

The Amendment to NBR 6118 is expected to be published soon. Any changes will be studied and adapted if necessary.

NBR 8800

The recent 2024 revision contains numerous changes from the previous 2008 text that have been duly incorporated into MetalCheck. More details to follow.

Manager

More items in the Center Panel

Floor plans are sorted by their number and no longer by the name of the drawing.

Lattice slab drawings organized in the Truss group.

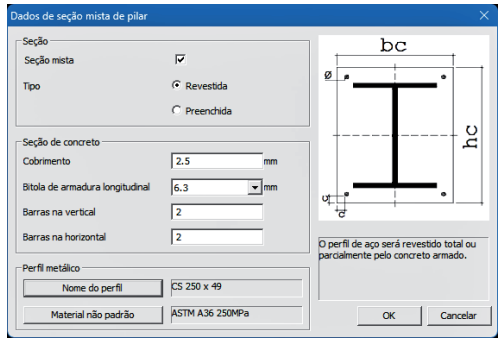
Tecncon Engenharia Estrutural, João Pessoa, PB

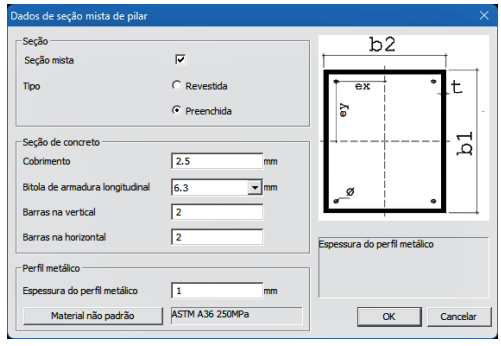
Structural Modeler

New mixed columns and more features to give you more control over your project

Mixed columns

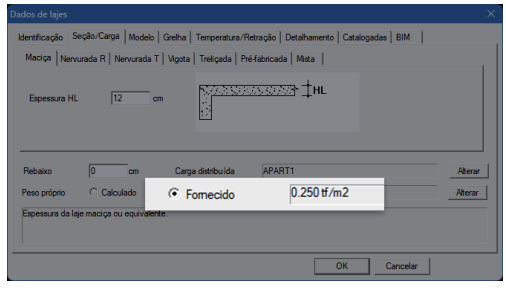
New family of mixed coated and filled abutments integrated with MetalCheck. More details in the following item MetalCheck.





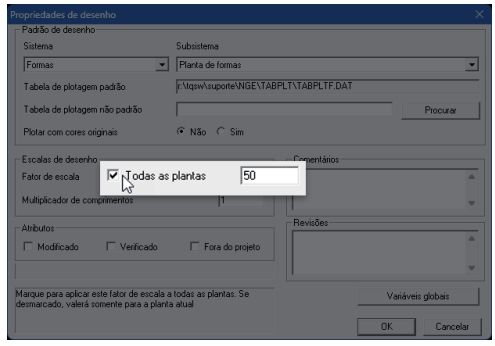
Slabs

Self-weight can be customized to simulate slabs with different shapes and materials.



Scale

Change the scale of all floors at once.



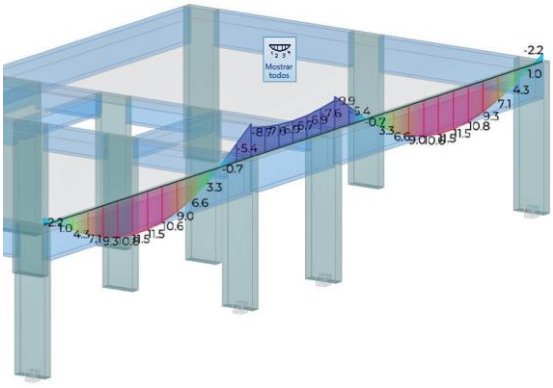
Structural analysis

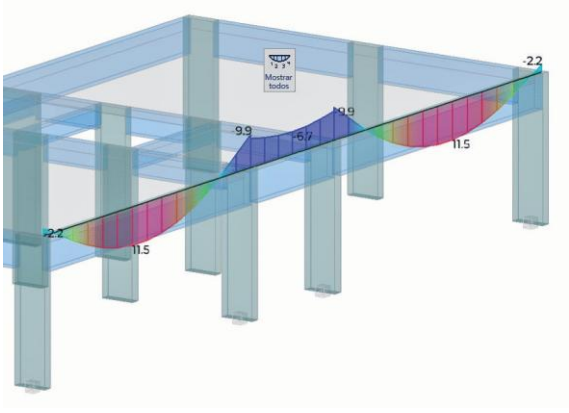
Easier interpretation of results. EPP and EPP3 packages with dynamics

3D Frame and Grid Viewers

Fewer texts

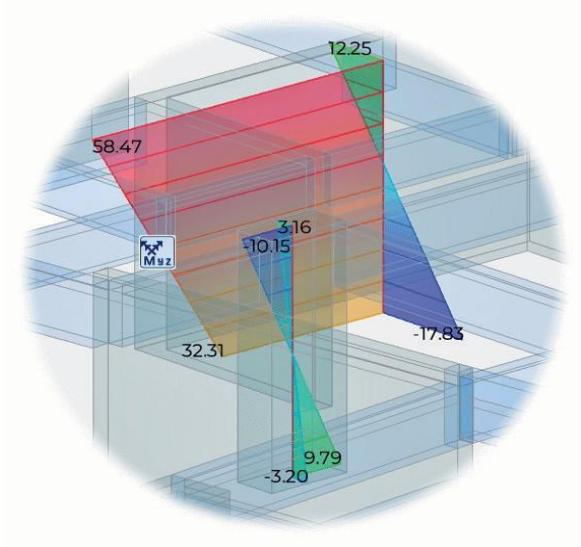
New command to view only the values that matter.





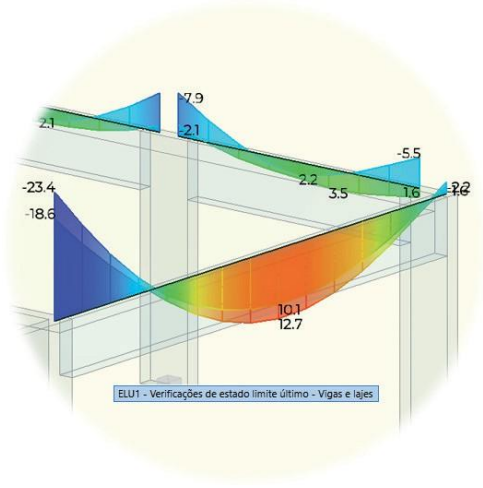
Simultaneous moments

Easier interpretation of flexural moments in the columns.



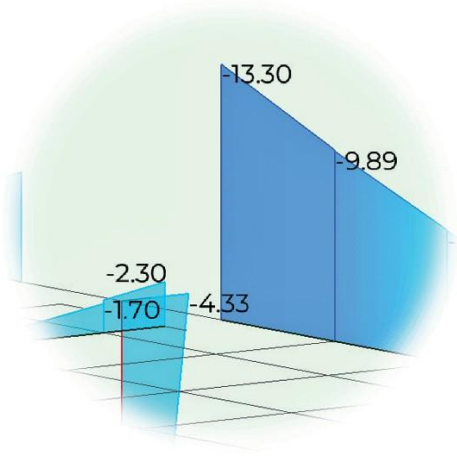
Envelope

Now with all extreme values detected, independent of the signal.



Font

New texts fonts.

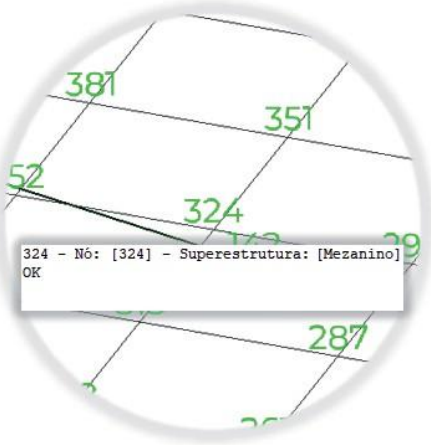


Alternative support

Data is on the property table.

Find text

More information about the localized node.



Save DWG

Color scale and reaction table saved to the file.

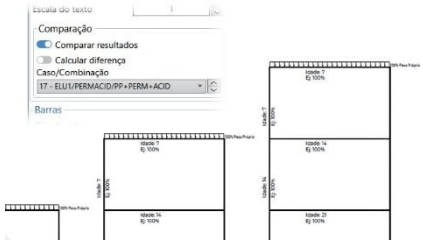
Menu Ribbon

Most commonly used controls were strategically repositioned.

Construction Sequence Analysis

Visualizer

It is now possible to compare results between any calculated combinations with a constructive effect.



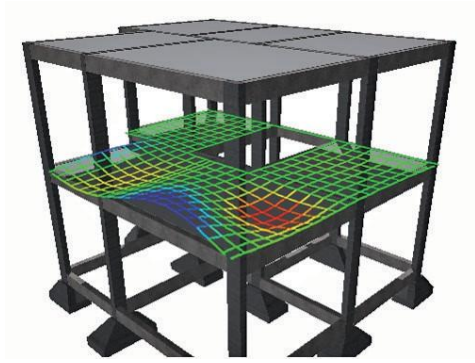
EPP3 and EPP packages

Dynamics

Modal analysis was introduced in the light solver. This means that the excessive vibration limit state (SLS-VIB) can be evaluated in small structures.

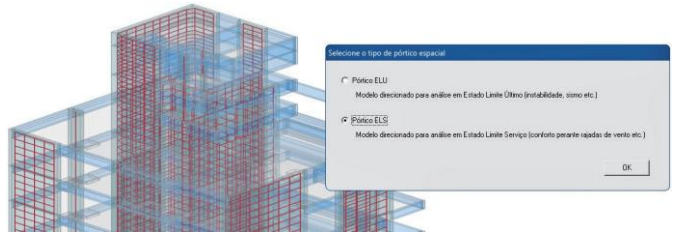
Non-linear grid analysis

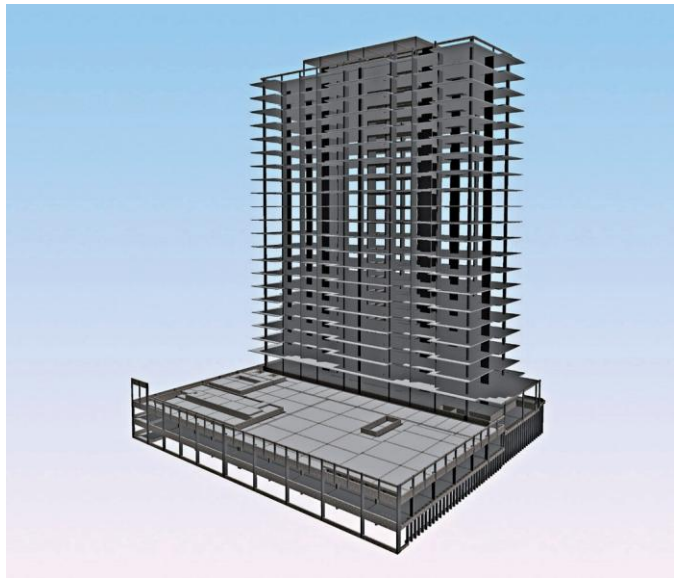
Adapted for the light solver, the analysis of deflections and crack openings with the non-linear grating has become much faster.



Other news

The discretized shear-wall mesh was incorporated into the main 3D Frame (previously, it was in the substructures) for a slightly more accurate P-Δ analysis. ULS or SLS model selection in the Dynamic Analysis Viewer.





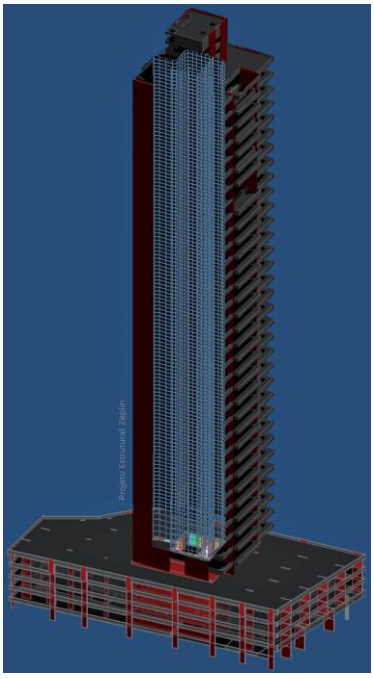
Nieri Engenharia, Londrina, PR

Columns

Two great novelties for wall columns. New 3D curve

Discretized shear walls

Fundamental in the structural analysis of rigid cores of tall buildings, the modeling with discretized wall-columns was revisited with the aim of improving the performance and its interface with the dimension of the reinforcements. As a result of this intensive research and development work, we are pleased to present two major novelties in the V26 version.



Faster

The automatic dimensioning of discretized wall columns in the V26 version is about 3x faster than in V25. An incredible reduction of about 70% in processing time.[1]

Groups

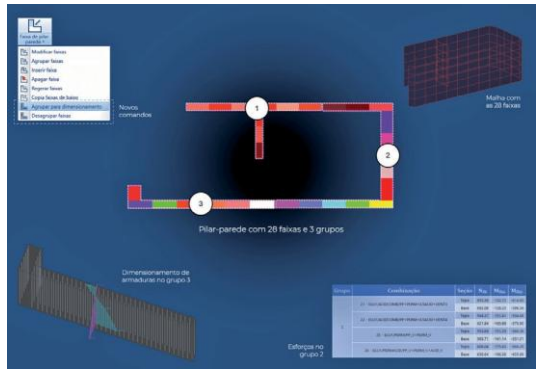
The discretization of the column-wall strips has a direct influence on both the structural analysis and the dimension of the reinforcements. In the V26 version, it is possible to create unique band groups for dimensioning to obtain more suitable reinforcement rates.[2]

More about the groups Styler

New commands have been added in the Structural Modeler for creating/editing track groups.

Spatial Frame

The densest bar mesh in the spatial frame continues to be generated according to the discretization of the stripes to ensure accurate responses in the structural analysis.



Design

Strip groups are used exclusively for reinforcement design. Each group is automatically dimensioned with integration of the cross-section and the stresses requesting the bands.

Verification

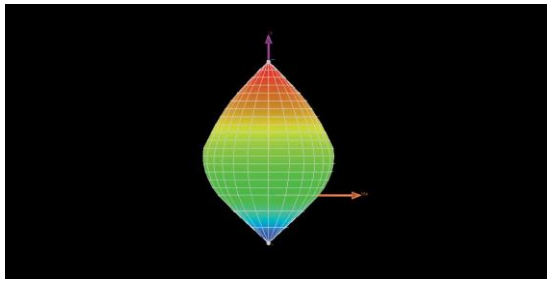
A new report is generated with all the information of the tracks and groups. In the Gungun Quick Editor, you can check the groups graphically.

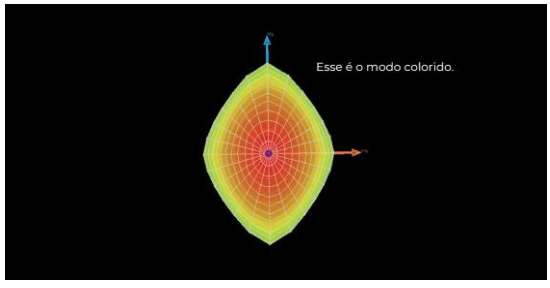
RF Engenharia e Projetos, Cotia, SP

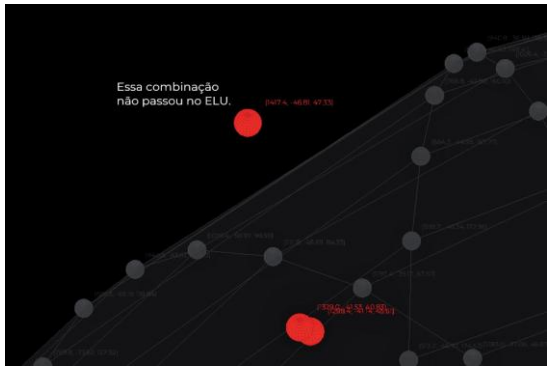
1. *The reduction depends on several factors, including the number of discretized shear walls in relation to the total number of columns. In the building next door, for example, the reduction in the time to process the columns was about 80%.*
2. *The Required armor rate can decrease if groups are properly defined.*

3D Curve

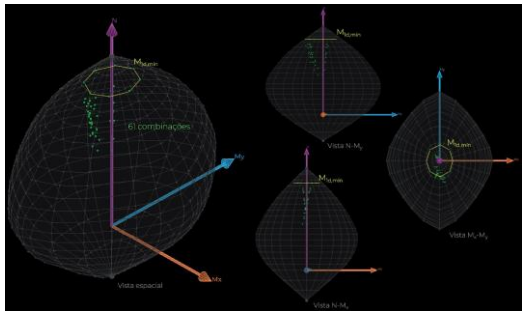
It's not just about prettier viewing. The new N-Mx-My rugged curve provides more fluid and immersive navigation within a purely 3D environment. It has a color viewing mode and a specific one for verification.



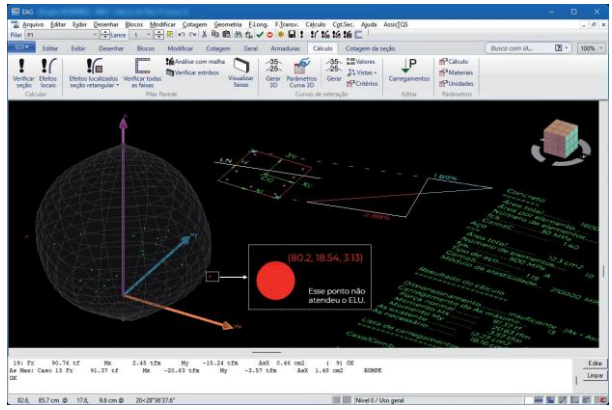


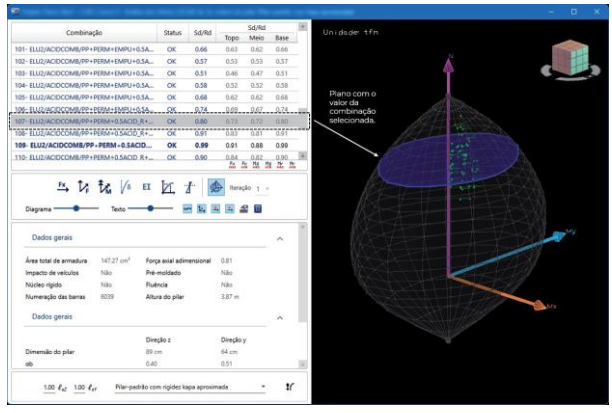


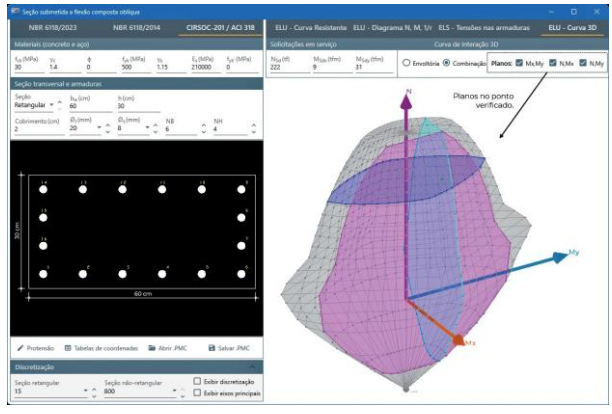
Easier interpretation of results. Start to graphically see situations that went unnoticed.

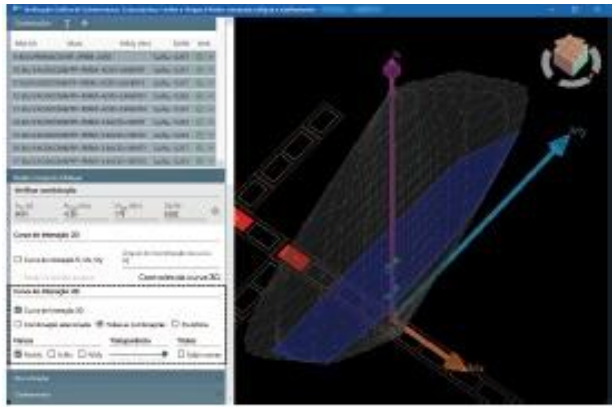


The 3D curve is available in the Column Ripe Quick Editor, the 2nd Order Effects Viewer, the FCO Calculator, and the Alvest Calculator.



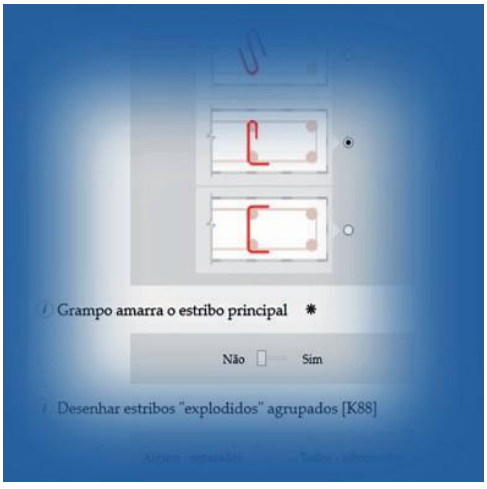






Column Ties

More control between shape and tie with the stirrup.

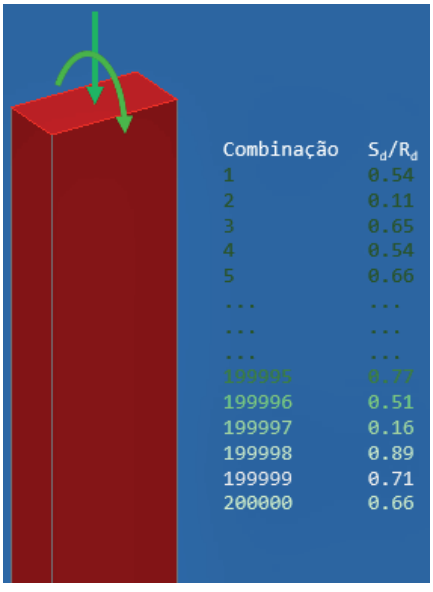


Shear

New check, with warning in drawing and report.

Combinations

Increased the limit of combinations on columns.

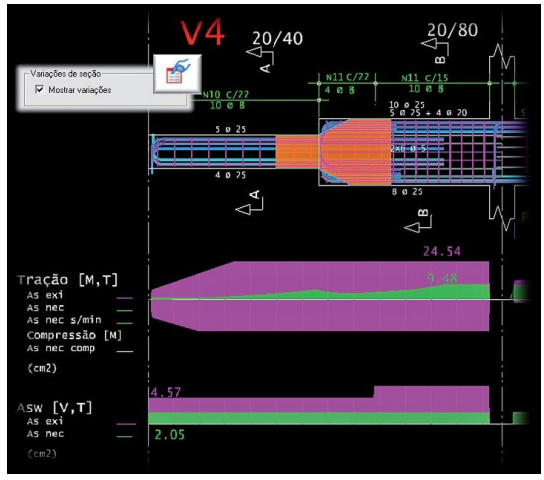


Beams

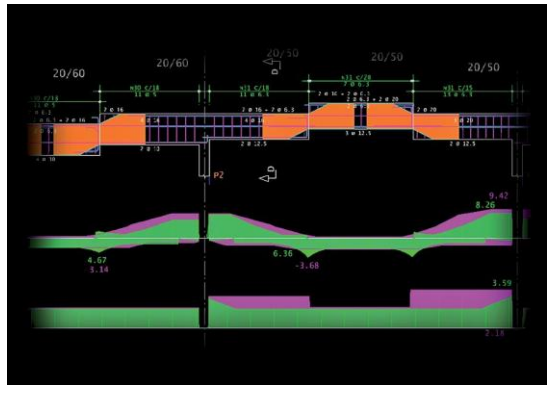
A new experience, from visualization to verification

Quick Rebar Editor

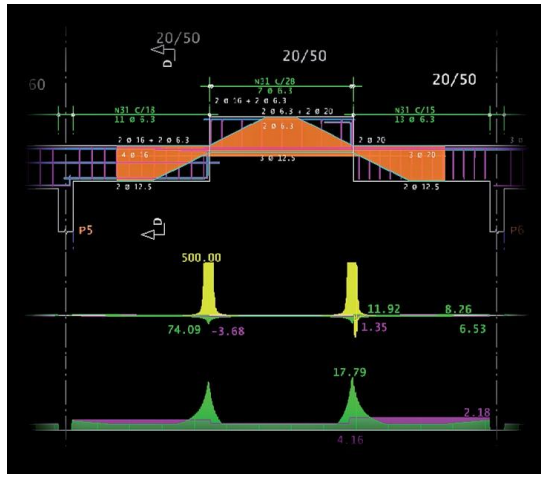
Point-to-point accuracy. Diagrams of *Required Reinforcement x Existing Reinforcement* for Bending and Shearing Considering the Effective Dimensions of Width and Height of Beams with Section Variation in the Middle of the Span.



View the section considered for the reinforcement valuation diagrams. Identify potential over-weapons.



Or armor in need of complement.

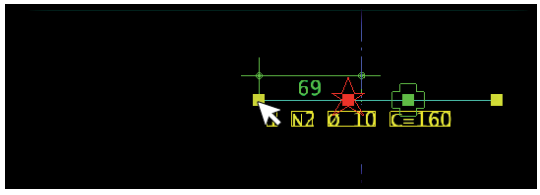


Or if the beam section in any section is insufficient.

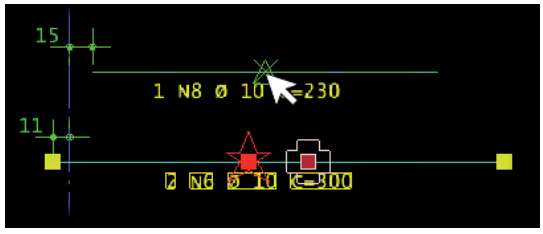
Edit your armor with the fluidity of interactive grips.

Directly in the graphics window, there is no need to search for commands on the Ribbon.

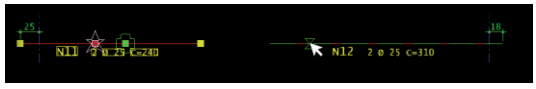
Change the tips with clicks and a simple drag.



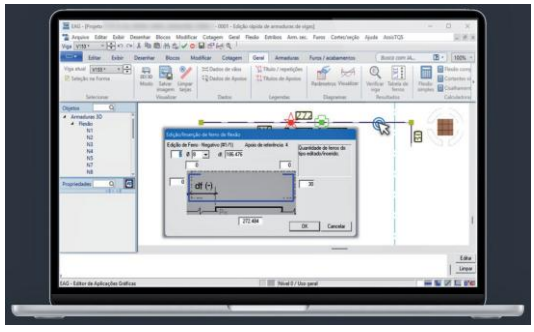
Group Rebar.



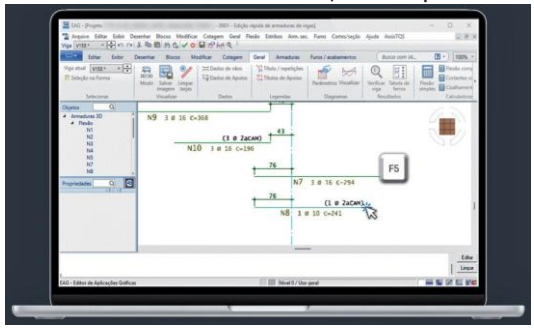
And put them together.

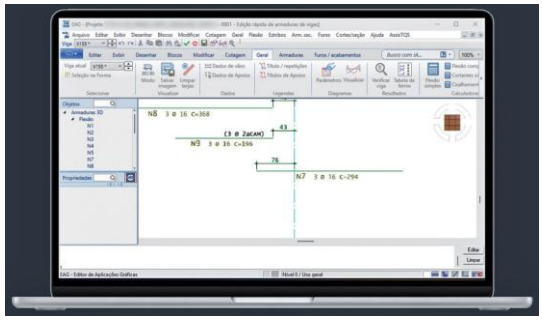


Double-click to edit any armor.

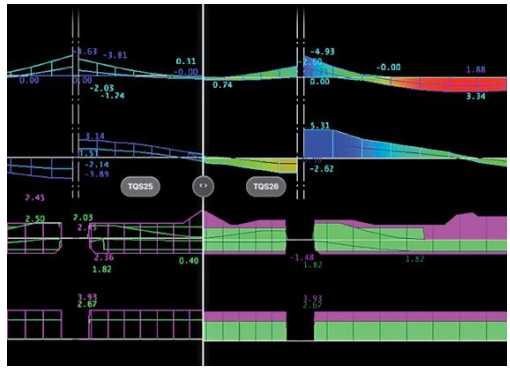


F5 To erase. Fewer clicks, more productivity.

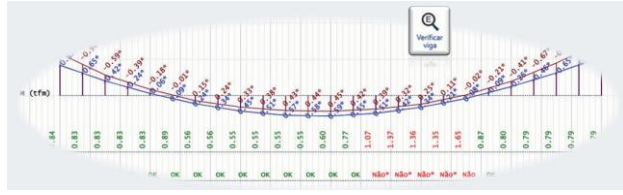




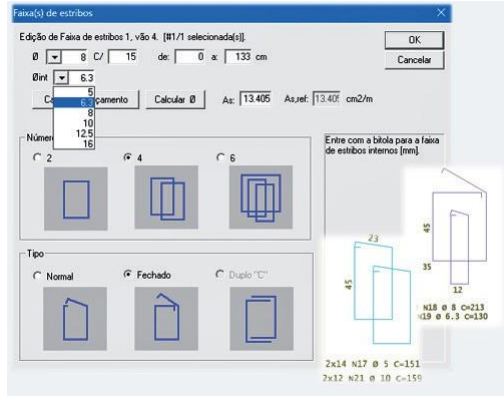
Diagrams with color gradient. A clearer and more intuitive visual, to understand the efforts immediately.



The beam check command now considers minimum moments and minimum reinforcement ratio. Indicates where the minimum moment was preponderant and signals when the minimum reinforcement rate is not met in the section.



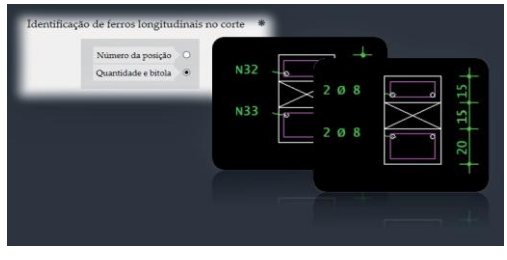
A more refined calculation that adheres to reality. It is now possible to edit the diameter of the stirrups internally. The system now considers the specific gauge of these stirrups in the shear check in cases of 4 and 6 branches in torsional sections.



Openings

New option to identify the hole reinforcements for more flexibility.

Optimization in the calculation of suspension reinforcement
for more savings.

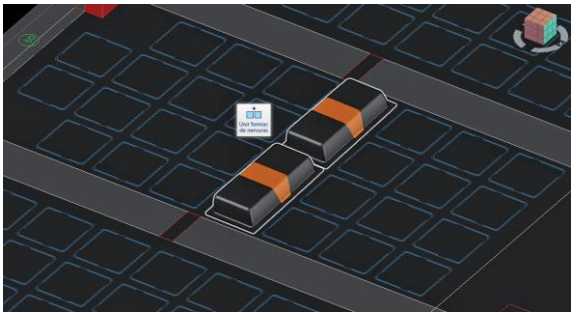


Slabs

New element for ribbed slabs and system improvements

Nerve Nullifier

We've added the join ribs command in the Structural Modeler to simulate the effect of rib nullifiers.

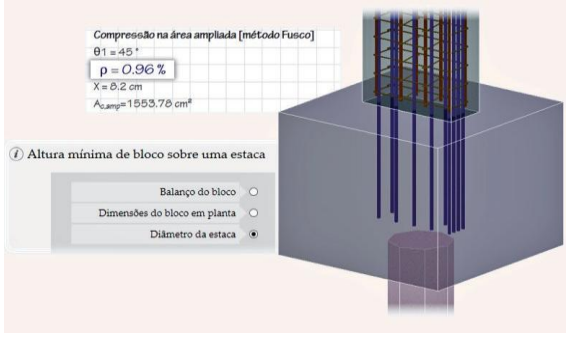


Foundations

Refinement in calculation. New cargo plant

Foundation Blocks

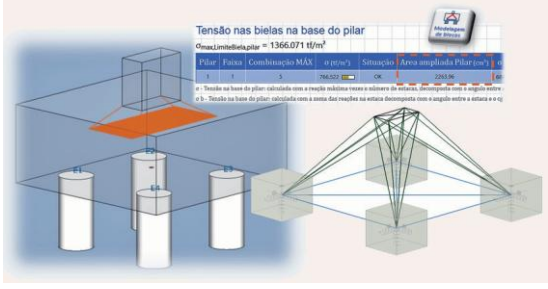
TQS V26 brings important advances: minimum height of blocks on a pile according to the main references, calculation of Fusco's Method A with actual armor of the start of the column, improved block reports and automated editing of reinforcements, which adjusts the spacing when changing the diameter.



Generic block modeling

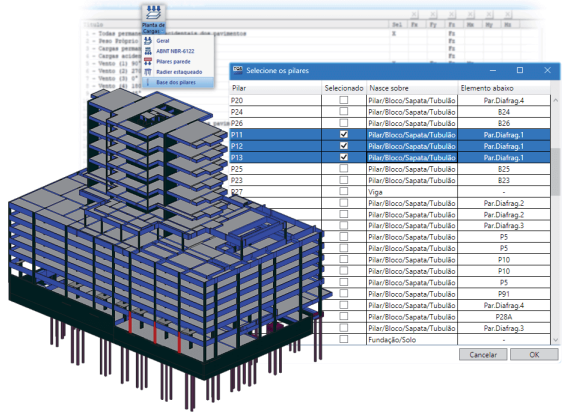
In the generic modeling of blocks, the enlarged area of the column is now considered in the verification of the connecting rod, giving even more rigor and consistency to the calculation.

Tie rod settings are now automatically maintained when closing the program to improve your workflow.



Loading plant

Manages the load plan at the base of all columns and meets specific situations, such as columns on curtains or radier. Select only the desired columns and automatically generate the load plan, ready for analysis and documentation.

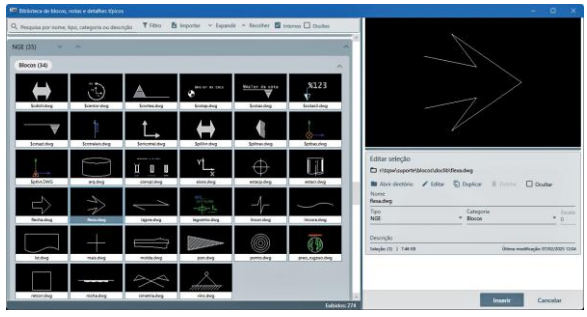


Catalogue of drawings

Organized management of drawing blocks and new typical project notes

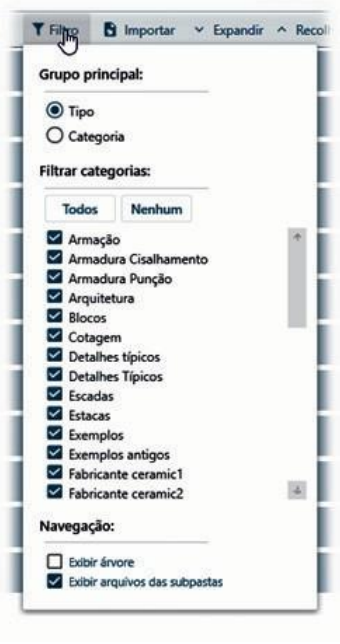
You can now manage all your sketchpads from the same interface, with categorization and thumbnails.

See how much easier it has become to discover and find distributed drawings with the system.



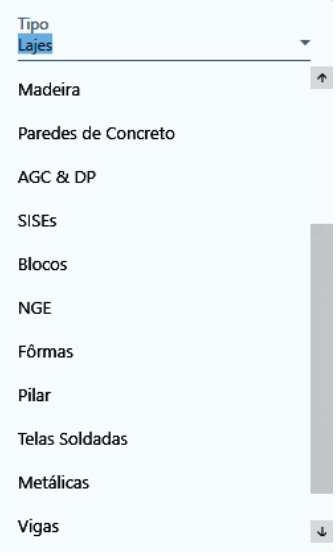
We organize the blocks we provide into categories and subcategories.

Added filters and search to make it easier to find.



We put controls so that the user can also classify their drawings.

After all, the goal is for the manager to really show all the drawings



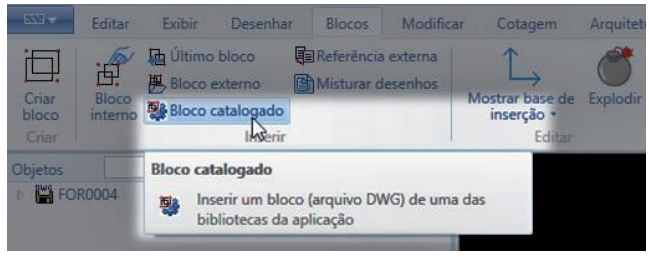
In this same editor, we provide several typical project notes.

Drawing Edit

If you need to edit a block, we've made it easy to open the graphic editor by double-clicking on the thumbnail.

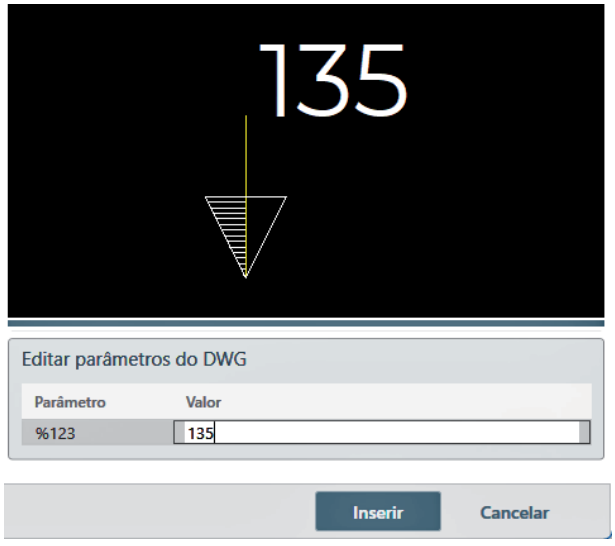
Graphic editor integration

Now, in the graphical editor, when using the Cataloged Block command, this new interface opens to locate the block to be inserted.



Attributes

If there are attributes to be filled in, this can be done in the side menu and the result can be previewed in real time.



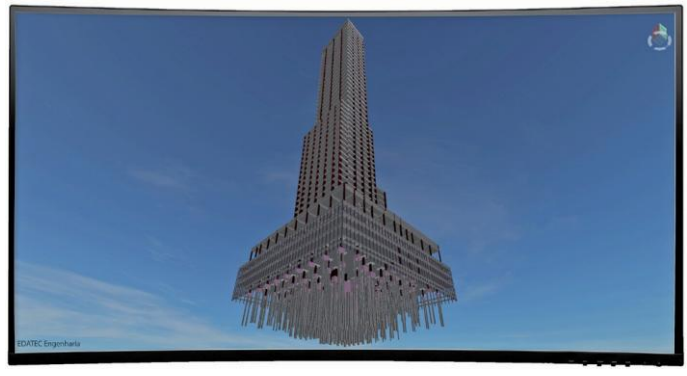
3D Viewer

Three-dimensional visualization enhancements with new technologies and text capabilities

Direct3D

Direct3D rendering now has all the visualization capabilities that previously only existed in OpenGL.

Examples are: texture, shadow, lighting, image or 3D background, crop planes and more.



BIM

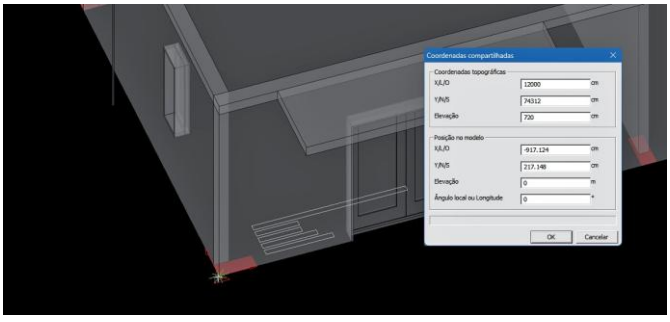
Improved integration with BIM tools and new import capabilities

Shared coordinates

Often the BIM model is made compatible based on topographic coordinates.

Therefore, we have simplified the compatibility of coordination's, it works like this:

In TQS, the user chooses a point in the model and defines the coordinates and rotation that that point will reference.



In Revit®, with the same coordinate system defined, the user imports the model via plugin.

The model is automatically transformed to make both coordination systems compatible.

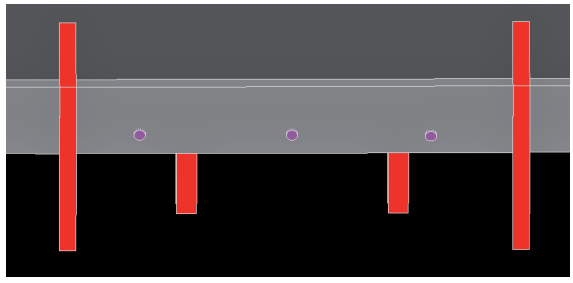
Drilling Markings

Importing tubes was already possible in previous versions of TQS.

Now, it is also possible to import hole markings, which are the final volumes defined in BIM necessary to hold the pipe and its proper clearance.

With these imported elements, holes can be created automatically with a command, and reinforcements will be calculated in processing.

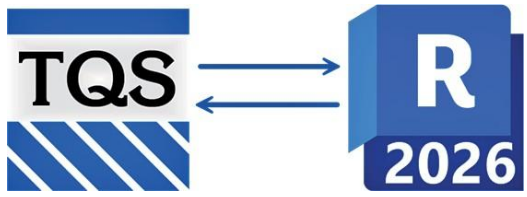
To this end, we follow Abrasip's recommendations for standardization of IFC holes.



Plug-in TQS x Revit® 2026

We have adapted our plugin with Revit® to ensure compatibility with Revit® 2026.

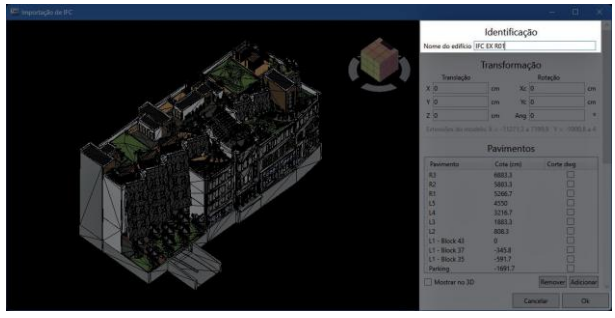
The new plugin is also compatible with TQS V25.



IFC Import

Building Title

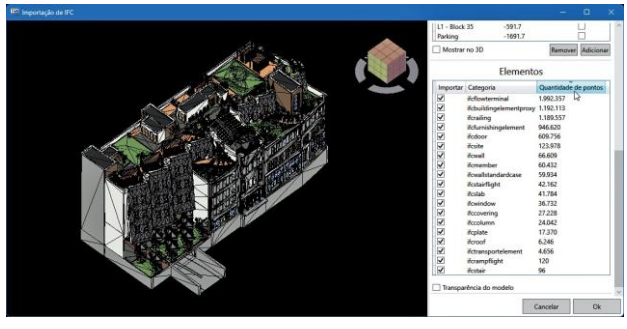
It is now possible to customize the title of the building in the preview window, before creating it.



Sizes by category

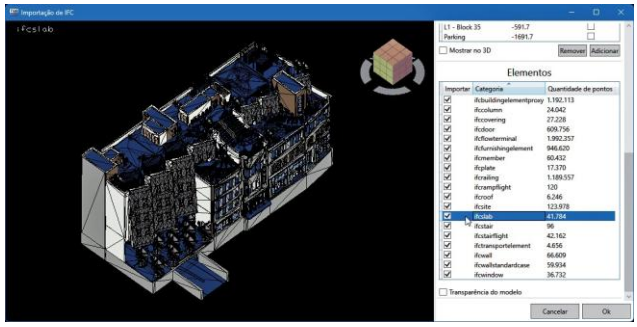
To facilitate the cleaning of the IFC, we put the number of points that each category adds to its geometry.

Re-ordering by number of points makes it easier to search for the categories that take up the most space in your memory.



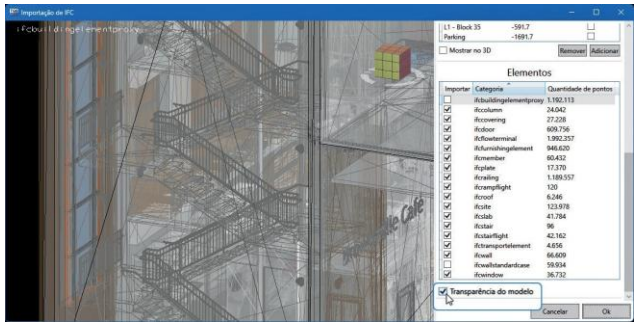
Category Selection

When you select a category, in the graphic area or in the category table, it is highlighted in the 3D preview.



Transparency

To make it easier to see inside, we've added the option to turn on the transparency of the model.



MetalCheck

New ABNT NBR 8800:2024 and mixed columns in the Structural Modeler

ABNT NBR 8800:2024

The 2008 ABNT NBR 8800 was replaced by the new 2024 version, updating 16 years of experience in steel structure design.

The revision impacts the formulations of all metallic and mixed elements treated by MetalCheck.

Compression

The formulation of the slenderness index λ_0 has been revised, also changing the resistant normal force $N_{c,Rd}$.

Shear force

The calculation of the coefficient K_v was revised by changing the resistant shear force V_{Rd}.

Bending moment

It has undergone some changes, among them the determination of the coefficient C_b that directly impacts on the resistant bending moment M_{Rd}.

In our tests, we showed changes of up to 20% in the resistant value;

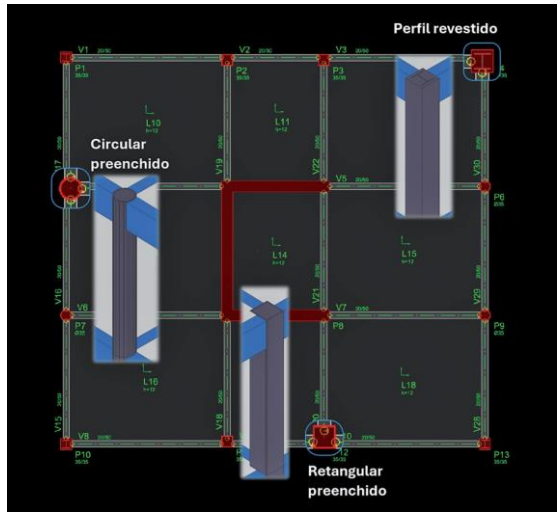
Mixed columns

It has been heavily revised, with direct changes in the calculation of the resistant normal of calculus $N_{c,Rd}$

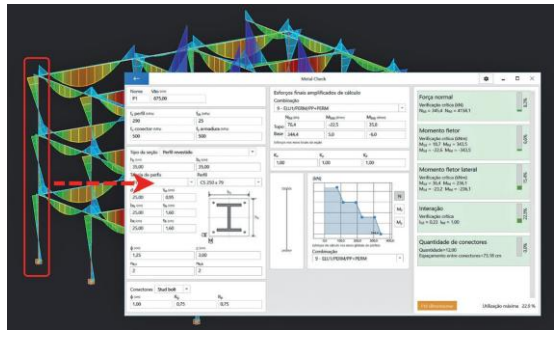
Mixed Columns in the Structural Modeler

It is now possible to cast composite columns in the structural modeler, including mixing with reinforced concrete elements.

The available types are: rectangular filled and re-coated (with fully or partially in-recessed profile), and circular filled.

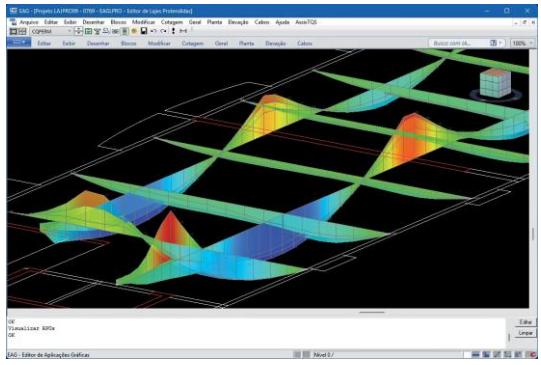


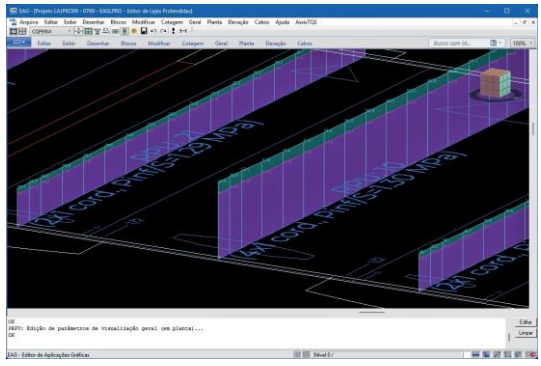
And use modeling along with TQS efforts for sizing in MetalCheck.



The processing also generates a table with the quantities of the new elements.

Perfil	Peso (t/m)	Compr. (m)	P. Total (t)
CS 250 x 79	0.079	8.750	0.692
CS 250 x 79	0.079	8.750	0.692
CS 250 x 79	0.079	8.750	0.692
CS 250 x 79	0.079	8.750	0.692
RET-35x35	0.207	8.750	1.813
RET-35x35	0.207	8.750	1.813
CRC-35	0.163	8.750	1.424
CRC-35	0.163	8.750	1.424
CRC-35	0.163	8.750	1.424
CRC-35	0.163	8.750	1.424
RET-35x35	0.207	8.750	1.813
RET-35x35	0.207	8.750	1.813



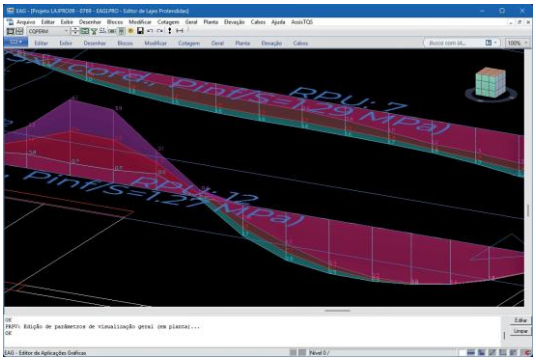


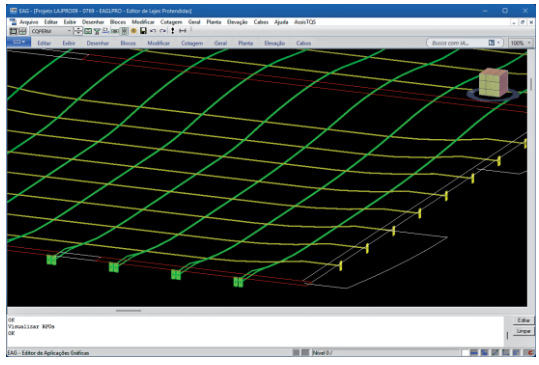
Prestressed Slabs

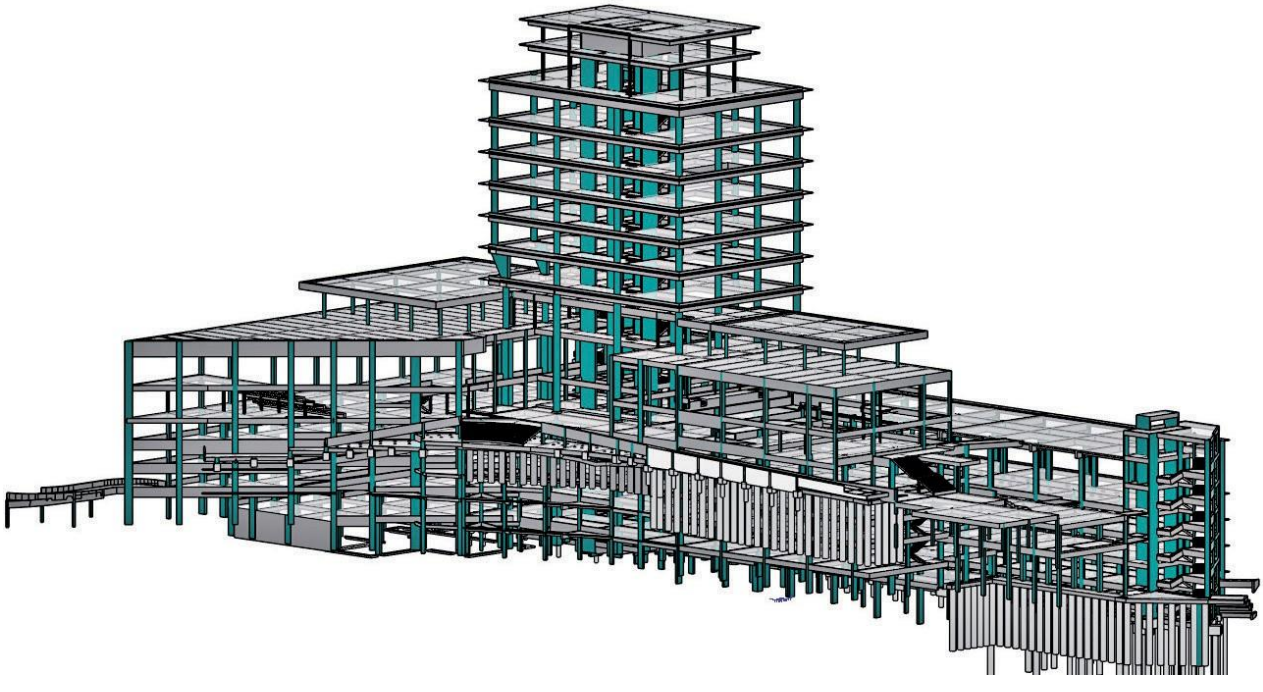
3D editor and new drawing options

3D visualization

The 3D graphics engine has arrived in the Prestressed Slab Editor. As a result, new cable drawing options and three-dimensional diagrams are available, including gradient colors. All RPU and RTE creation/editing commands remain the same, preserving your experience.



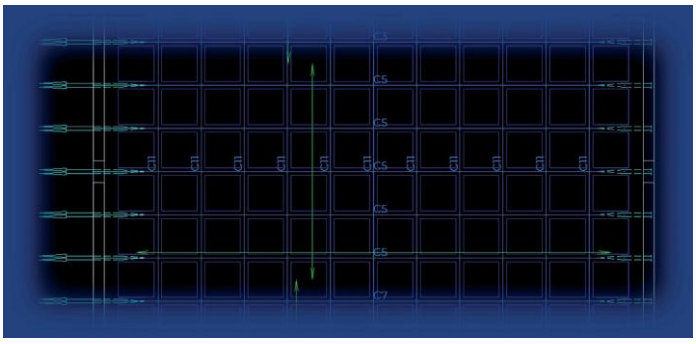




BEDE Engenharia, Belo Horizonte, MG

Anchor design

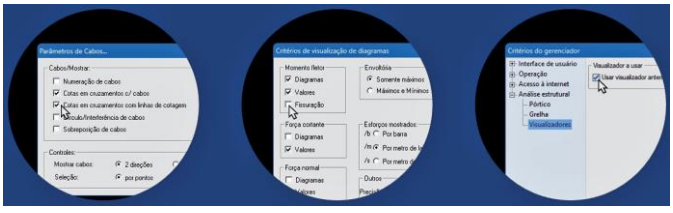
New drawing blocks with better representation of active and passive anchors.[1]



More options

Visualization of dimensions at the intersection of cables and additional dimension lines controlled by isolated visualization parameters.

New parameter that allows activating/deactivating the visualization of the cracking moment in the diagrams in plan. Option to use the previous Grid/Frame Viewer.

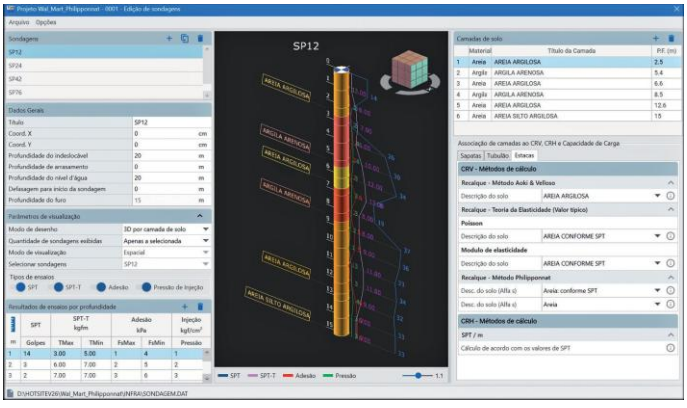


Sises

New 3D Survey Editor with an even more user-friendly interface

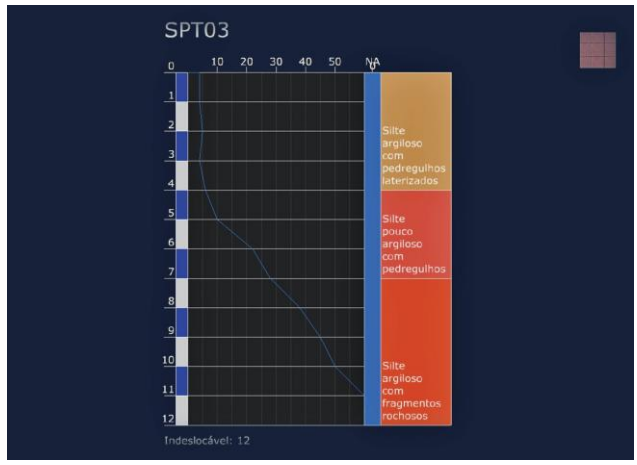
New SPT Editor

Rewritten to simplify the process of creating and entering data related to drilling and soil layers, the new editor brings everything together in a single window, with faster and more intuitive filling.



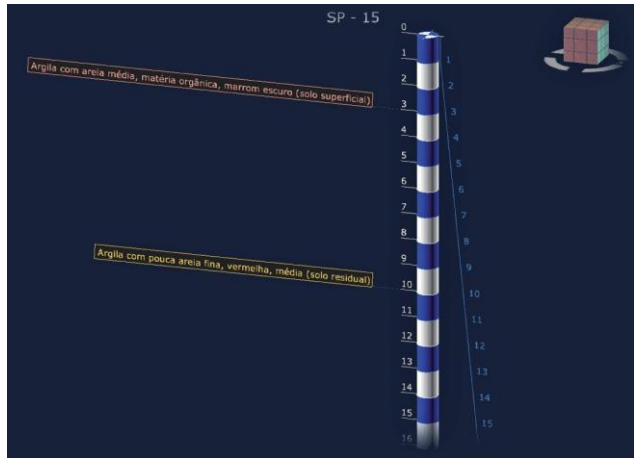
Soil layers with maximum clarity

Multiple viewing options.

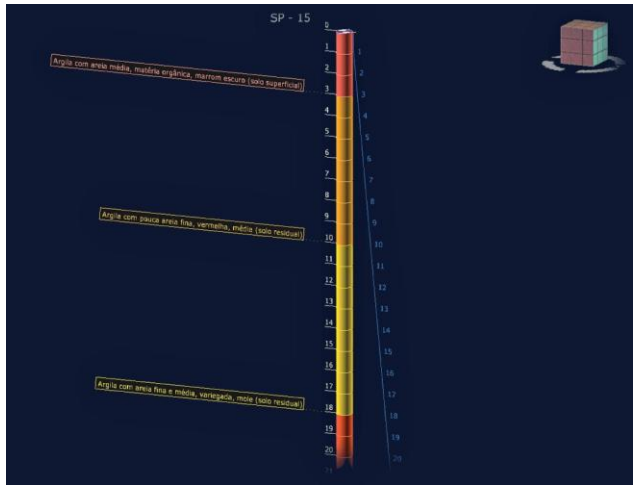


More colors. More enjoyable. More 3D

Explore soil properties in 3D with depth-defined colors, making it easy to interpret visually.



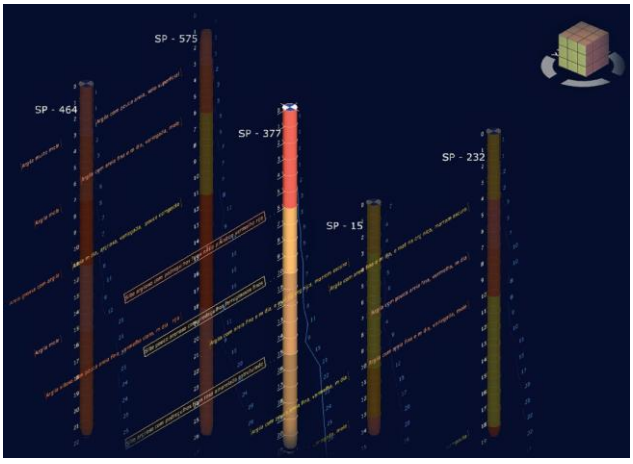
Three-dimensional visualization with colors assigned to the different soil layers.



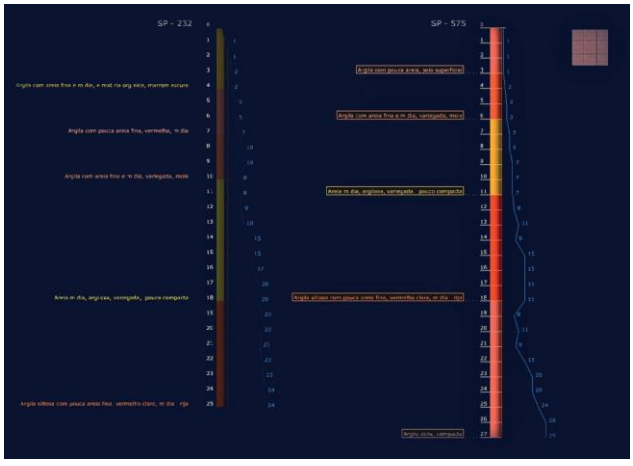
1. *The old drawing blocks have been preserved and can be restored if needed.*

Simultaneous visualization of multiple holes

All boreholes in perspective at once in 3D mode.



All boreholes in perspective, at once in comparative mode.



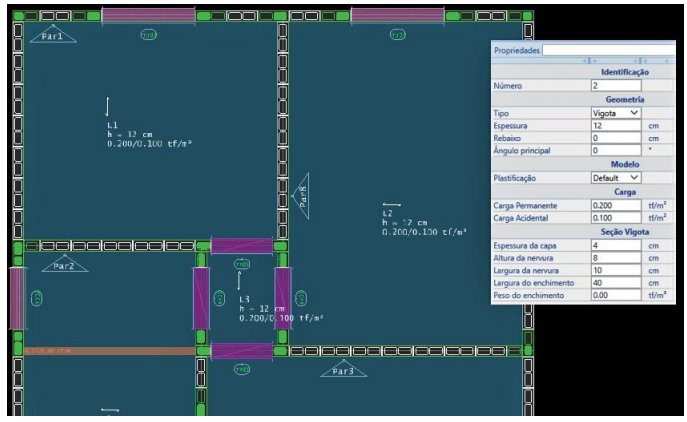
N+UNO Ingeniería, Córdoba, AR

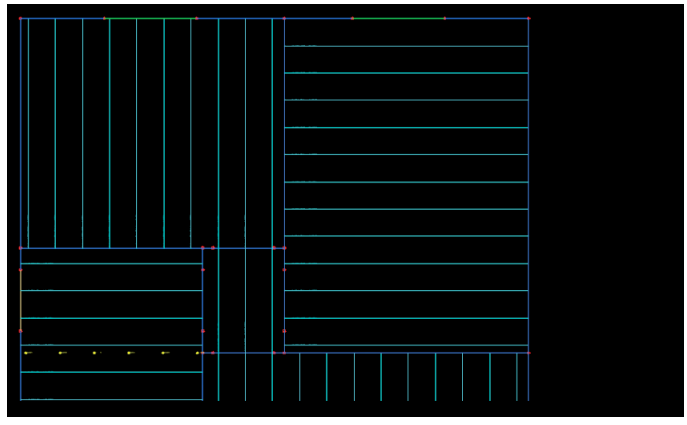
Alvest

Structural Masonry Modeler Enhancements, Fabricators, Calculators, and More

Ribbed Slabs

A new type of slab has been added: joist slab. The joist slabs are modeled in a unidirectional way and the self-weight is adjusted according to parameters.

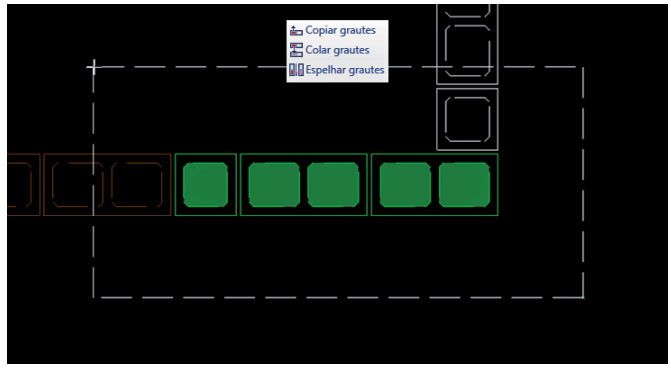




Imposition of grouts

The imposition of grouts is an operation that takes a lot of time from the engineer. With this in mind, we have made new commands available:

- Copy and paste grouts: to copy grouts between floors;
- Mirror grouts: for mirroring grouts on the same floor with axis of symmetry.



Continuous Dimensioning

New command to add new dimension lines from the last dimension with one click.

Display parameters

We have introduced the quick view mode, designed to gain performance in larger buildings.

Block distribution

We have improved the block distribution algorithm; With this, it was possible to avoid overlapping with imposed blocks.

Graphic verification of masonry

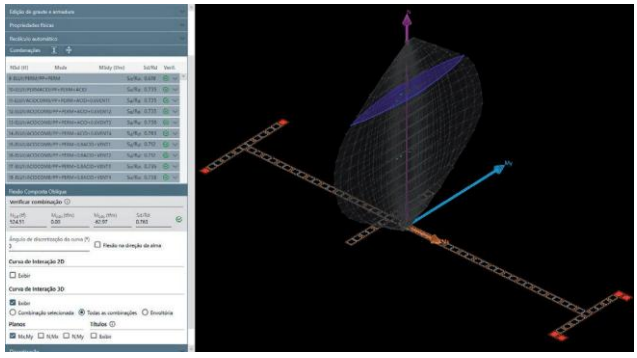
The N-Mx-My tough curve is now drawn in 3D, graphically providing an overview of all checks.

Command to insert grout along with pre-selected armor, for faster definition of reinforcements.

New control to turn off automatic recalculation of checks. In larger buildings, the user will be able to trigger the check only when necessary.

MRG Projetos Estruturais, São Paulo, SP

The calculator has also been revised and there have been improvements in performance.

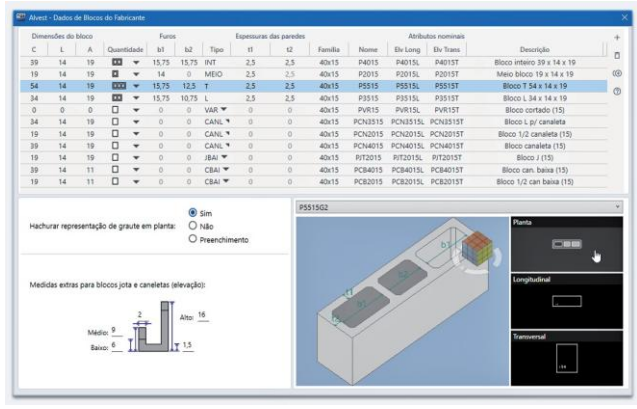


Masonry Block Editor

It is now possible to view and directly access the gorged block drawings through the editor.

Variations are automatically generated at edit time.

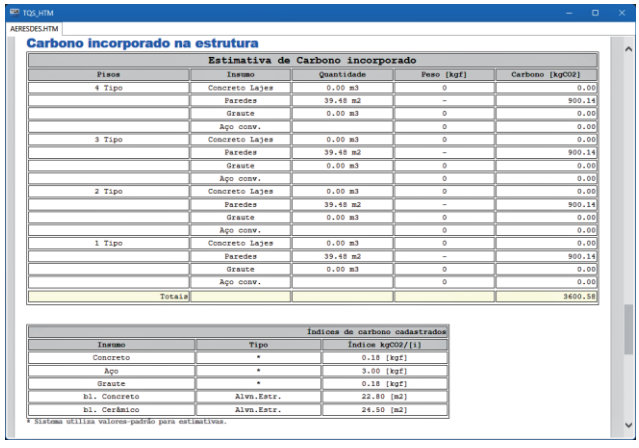
In addition, the editor is performing better.



Embodied Carbon Indices

New table with the estimated carbon index incorporated in the "Costs of materials" report.

The rates used in the estimate can be calibrated on criteria.



Carbono incorporado na estrutura

Estimativa de Carbono incorporado

Pisos	Insumo	Quantidade	Peso [kgf]	Carbono [kgCO2]
4 Tipo	Concreto Lajes	0.00 m3	0	0.00
	Paredes	39.48 m2	-	900.14
	Graute	0.00 m3	0	0.00
	Aço conv.		0	0.00
3 Tipo	Concreto Lajes	0.00 m3	0	0.00
	Paredes	39.48 m2	-	900.14
	Graute	0.00 m3	0	0.00
	Aço conv.		0	0.00
2 Tipo	Concreto Lajes	0.00 m3	0	0.00
	Paredes	39.48 m2	-	900.14
	Graute	0.00 m3	0	0.00
	Aço conv.		0	0.00
1 Tipo	Concreto Lajes	0.00 m3	0	0.00
	Paredes	39.48 m2	-	900.14
	Graute	0.00 m3	0	0.00
	Aço conv.		0	0.00
Totais				3600.58

Índices de carbono cadastrados

Insumo	Tipo	Índice kgCO2/[i]
Concreto	*	0.18 [kgf]
Aço	*	3.00 [kgf]
Graute	*	0.18 [kgf]
bl. Concreto	Alvn.Estr.	22.80 [m2]
bl. Cerâmico	Alvn.Estr.	24.50 [m2]

* Sistema utiliza valores-padrão para estimativas.

Compaction

Now the compressed file (. TQS) takes the external references of the Structural Masonry Modeler in the compressed file.

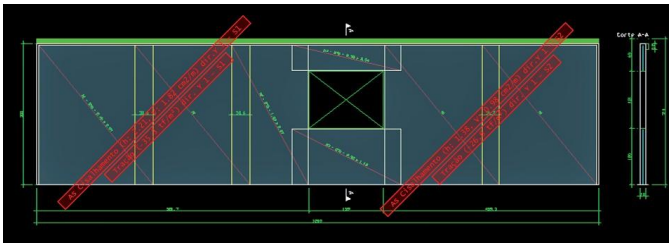
Concrete Walls

Automation in reinforcement verification, improvements in reporting and new sustainability parameters

Reinforcement check. More precision, more automation.

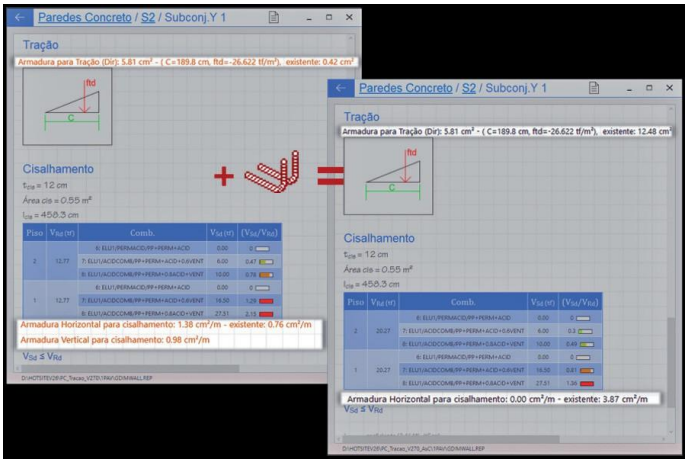
The tensile and shear reinforcements thrown by the user on the walls of the graphic input are now considered and verified by the program on each subassembly.

Stripes in the elevation of walls. If the reinforcement thrown at the walls by the users is sufficient, the system removes the stripes automatically.



Resistance of nd. In the envelope drawings, the warnings of the need for die reinforcement are removed and the reinforcements are represented.

In the report, it is possible to see, for each subset of the main substructure directions, the existing and necessary hardshells for shear and tensile.



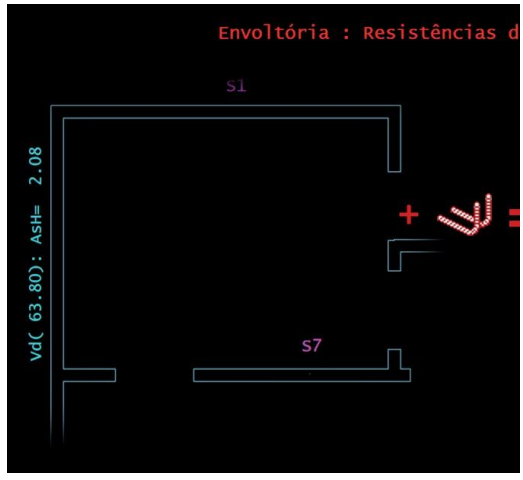
Issuance of serious errors. When the user-defined armature meets the check, serious errors disappear.

Stripes in the elevation of walls

If the reinforcement thrown at the walls by the user is sufficient, the system removes the stripes automatically.

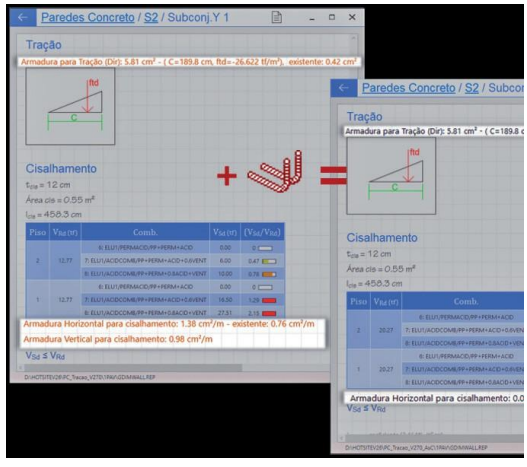
*Resistance of **nd***

In the envelope drawings, the warnings of the need for cutting reinforcement are removed and the rigid reinforcements are represented.



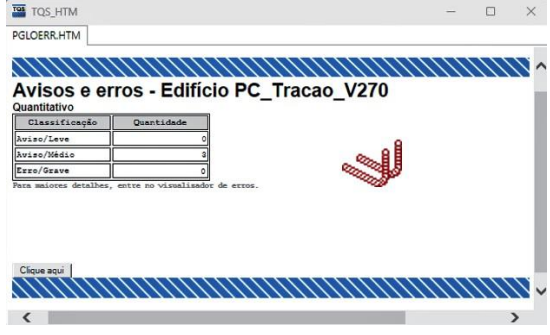
Reports

In the report, you can see for each subset of the main substructure directions the existing reinforcements required for shear and tensile.



Issuance of serious errors

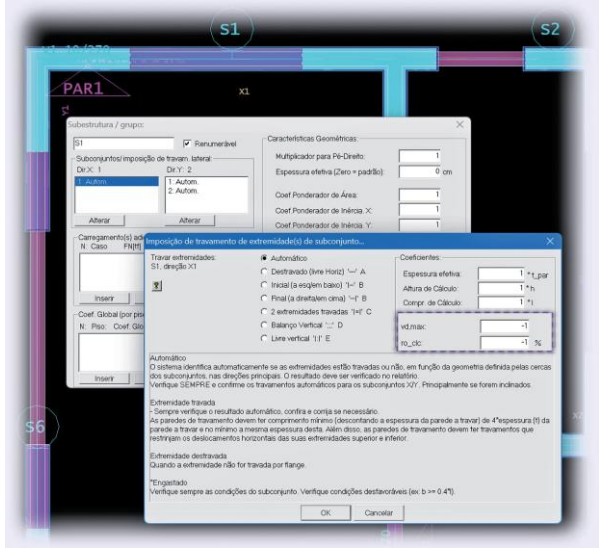
When the user-defined armature meets the check, the serious errors disappear.



Reinforcement in wall elevation

The conventional reinforcements imposed in the graphical input appear in all views—template, plan, and sections.

Possibility of editing the geometric ratio of the vertical reinforced tax and the limit of the calculation resistance (ν_{dmax}) by substructure.

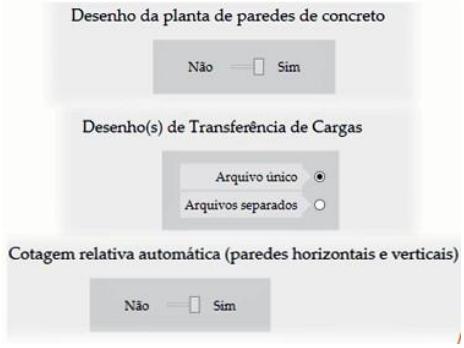


The Embodied Carbon in Structure section has been added to the Concrete Wall Material Cost and Summary report.

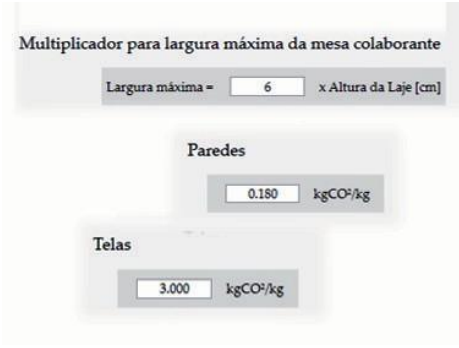
Total estimate linked to the model. Editable parameters for greater control. An objective basis for ESG decisions and requirements.

New criteria that impact both the structural calculation and the way drawings are generated. Accurate results, tailored to your project.

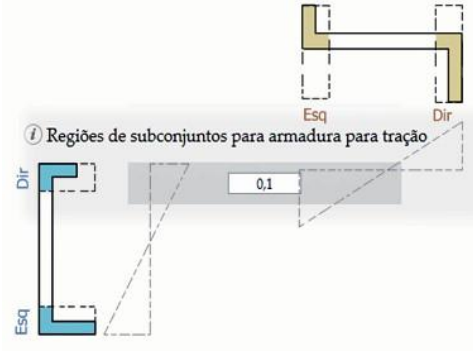
Design criteria. Define on the generation of the plant, choose between load transfer drawing in a single file or separate files and activate automatic relative dimensioning.



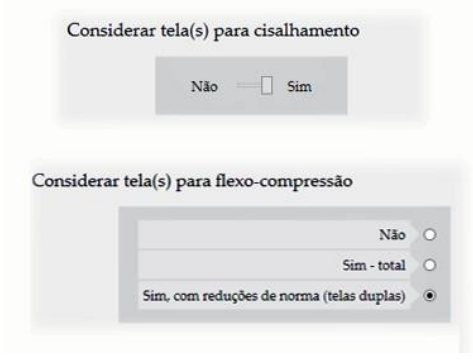
Set the maximum limit of the width of the lintel collapsing table according to the height of the slab. Enter embodied carbon values.



Configure the width of the tensile reinforcement subassembly regions according to the length of the subassembly.

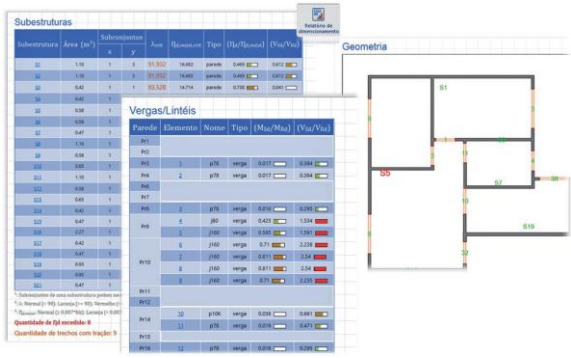


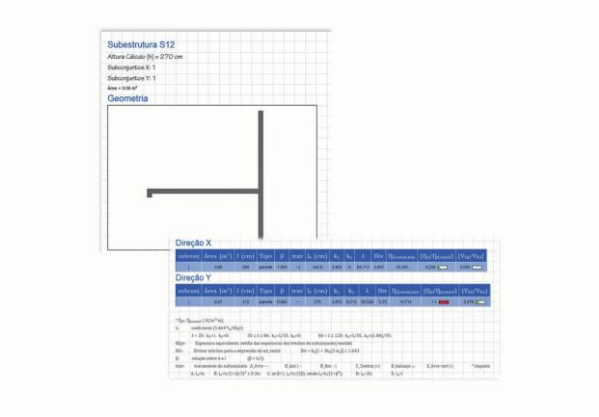
Decide whether screens should be considered in reinforcement checks.

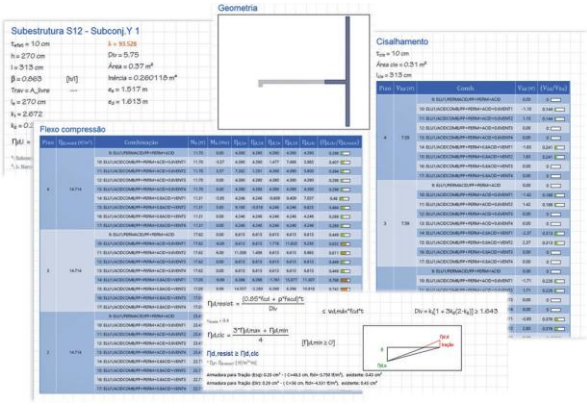


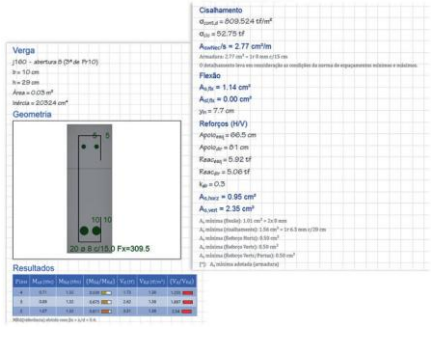
Even more complete report. With geometries, formulations, checks and results – all brought together in a clear presentation.

The report simplifies management and verifications while maintaining the uniformity of the other TQS systems.







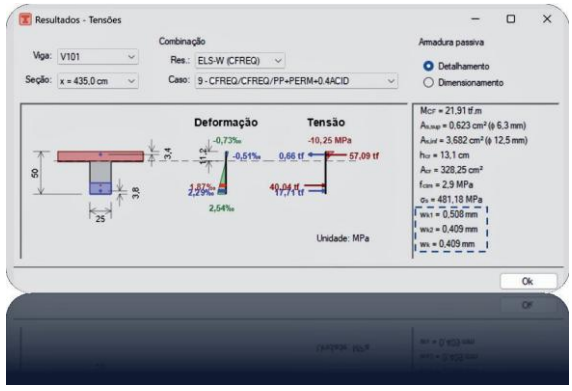


VPRO

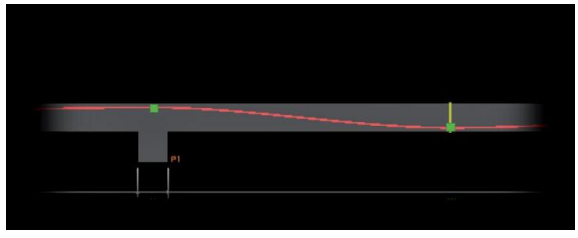
Capabilities for partial prestressing, productivity improvements, and regulatory updates

Partial prestressing

The program started to perform the crack opening check (SLS-W). Thus, it is possible to use beams with partial prestressing, in which cracking is the limiting criterion.

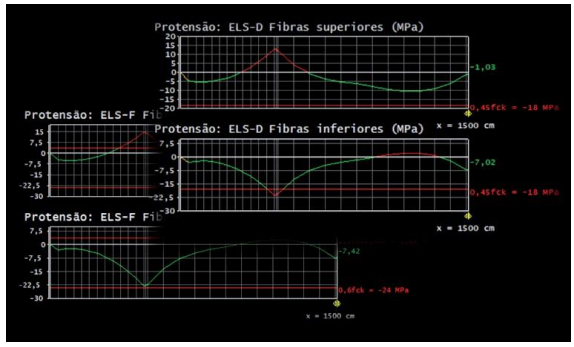


Visualization of launch points on the cable path.



Improved cable launch (Copying and renaming cables).

Indication of the maximum compression limit for SLS-D and SLS-F checks (Revision of NBR 6118:2023).



Python

Programming and automation with Python integrated with TQS

New functions expand the possibilities – the examples below show only part of what you can create

Interactive modeler

Interactive control: before, it was already possible to manipulate the model via API. Now, you can do this inside the Structural Modeler.

Use API functions to select, move, and rotate elements in real time, seeing it all happen on the screen. Count on built-in undo and redo — your changes are secure. Take your scripts to the TQS menu and zoom in on what the program does.

3D Models

Programmable 3D Modeling: new API module with functions to create and edit E3D spatial models.

Use prisms, trails, and generic solids to complete your 3D model. With creativity, it is possible to generate, via code, stairs, retaining walls, reservoirs and much more. Your BIM model can be more complete, and this step can be automated.

Automated boards

Make blueprint generation easier: A new API module for reading, manipulating, and writing CPL files.

Use the exported routines to organize boards and combine drawings via code. The new functions give the possibility to generate *the layout* for iron tables of the entire building. Automate the final step of your project.

Armor designs

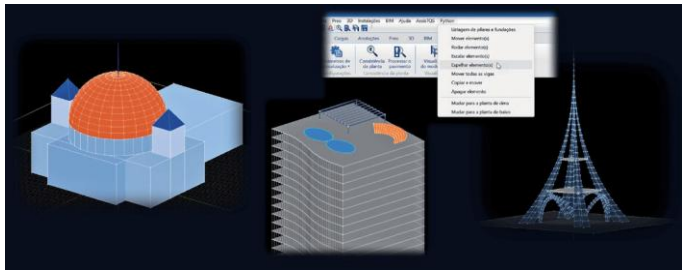
Iron manipulation: the drawings module now has new routines exported in the API.

Read the status of each drawing: modified, out of project, or checked. Use functions to move, rotate, scale, and mirror reinforcements via code. Adjust texts and identify frame designs in an automated way.

Artificial Intelligence as an ally

With the new generation AI tools, it's even easier to use Python in TQS. Just describe what you need, provide the Python/TQS API documentation, and AI helps you create the code.

A very powerful tool to optimize tasks and extend the program's features, your way.



In this section, the images were all generated from Python scripts in TQS made using AI.

Artificial Intelligence and TQS

We are attentive to the rapid evolutions of Artificial Intelligence. We have researched, tested and learned a lot.

Our goal is for AI to act in two main ways: as guidance — suggesting paths and best practices, almost like an experienced engineer — and as optimization, speeding up processes and making calculations more efficient.

We already use AI in internal processes to accelerate deliveries and solve complex challenges. And with our Python API, we've made room for integration that bring that future even closer.

We believe that AI will play an important role in TQS: not replacing engineers but expanding their decision-making and creation capacity.

The future of AI engineering has already begun.

The questions that guide us

What if the ***software*** could guide it like an expert?

Guidance: Support data-driven decisions, suggesting safe paths, and highlighting patterns that often go unnoticed.

What if the ***software*** revealed new possibilities?

Optimization: Identify economic and efficient scenarios, explore scaling alternatives, and streamline analysis—without sacrificing security.

What if the ***software*** could take on the repetitive?

Automation: Organize checks, prioritize critical items, and free up engineer time to create and solve complex problems.

Working with AI is challenging. We have already carried out several internal tests, learned from prototypes and continued to evolve. The goal is to deliver, in the future, solutions that really add up daily — with the reliability that TQS has always delivered.

Smart Responses in TQSDocs

In V26, the search in TQSDocs from within TQS now has a new integrated window, allowing you to re-alize the search both in the Manager and in the Graphical Editors — and view everything within the TQS itself.

In addition, the feature gains another powerful touch of artificial intelligence that automatically generates a summary of the results found. Answers are more direct and contextualized, making the query more agile and intelligent.

* Limitations on use may apply.

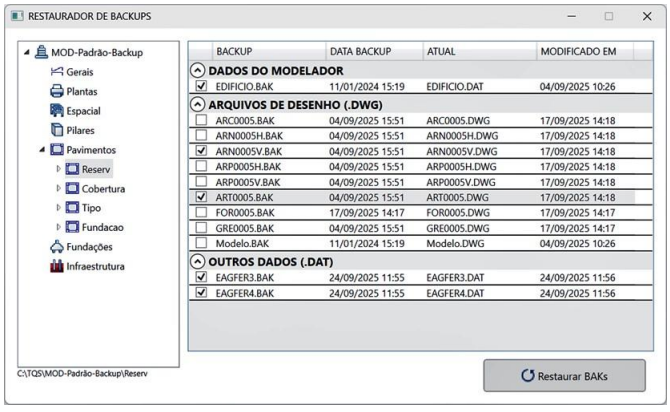
* The summary will be displayed only when there is a higher probability of a correct answer.

Other news

Other improvements implemented in version 26 to enhance your experience

Backup Restorer

Revamped interface to facilitate file recovery.

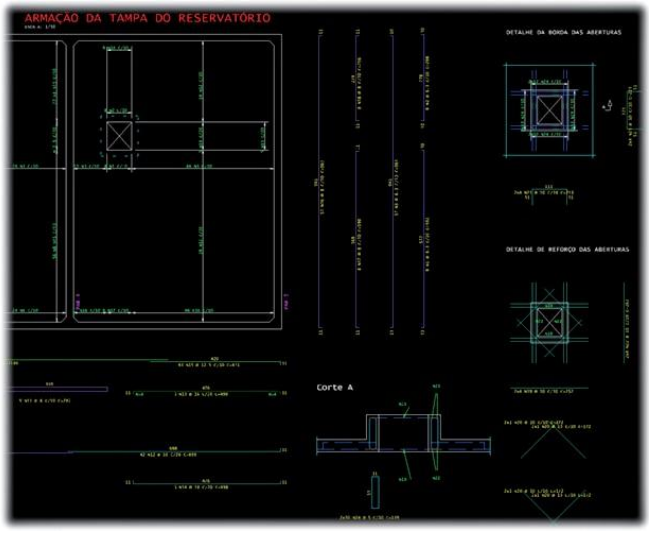


Calculators

Standardized interface and interface enhancements across multiple calculators.

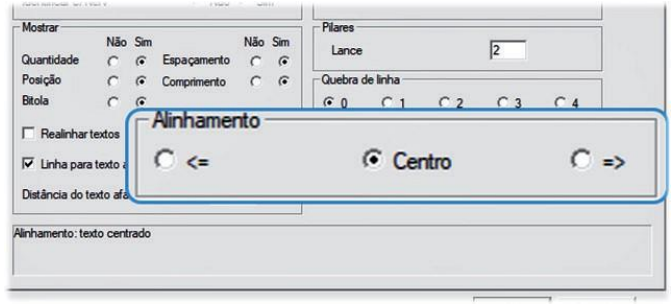
Reservoirs

The reservoir drawings were completely revised and there were improvements in detailing.



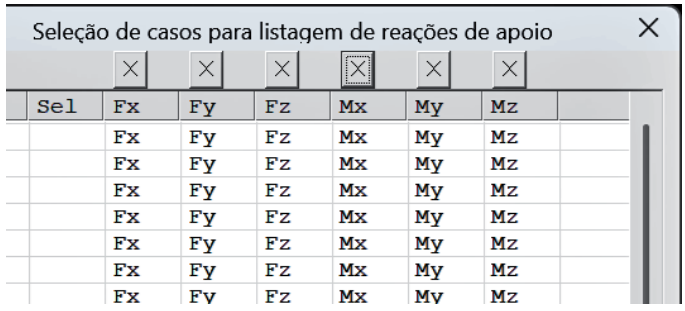
Smart reinforce

Multi-select text realignment for increased productivity.



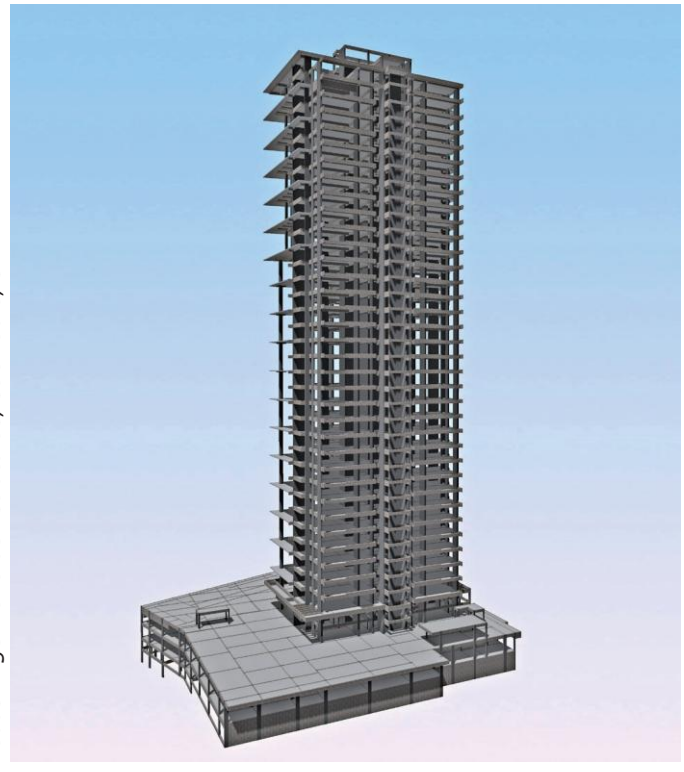
Loading plant

Added controls to make it easier to select combinations.



Sidac/BIP Indices

Direct integration with the Sidac/BIP system for sustainability analysis.



Modus Engenharia de Estruturas, São Paulo, SP

Tall buildings - The sky's the limit

Journalist Mariuza Rodrigues

Brazil takes on the trend of verticalization with buildings that already exceed the 500-meter-high mark

Brazil reached 2026 with the historic mark of 61 buildings above 150 meters in height. A single city – Balneário Camboriú, in Santa Catarina – concentrates 29 of these gigantic architectural monuments, with the incredible mark of 8 of the 10 tallest buildings in the country. The tallest Brazilian building is in Balneário Camboriú. It is the Yachthouse by Pininfarina, with 294.1 m, followed by the One Tower building, with 290 m, also located in the same city. But soon, they will be surpassed by the construction of The Tower, of 340 m and, in first place, the Senna Tower, of 544 m, all in Balneário Camboriú. The 1st to emerge was the Millennium Palace, of 177 m, in 2014. The leader of the world ranking (for now) is the Burj Khalifa building, in the United Arab Emirates, with the incredible mark of 828 m high.

But how to define a tall building? According to the Council on Tall Buildings and Urban Habitat (CTBUH), a tall building is more than 100 meters tall. The term *skyscraper, on the other hand,* defines buildings that stand out in the urban context. When the building exceeds 300 meters in height, it is called a *supertall*. And above 600 meters high, it is considered a *megatall*.

The Council considers the height of the architectural top, including the pinnacles, but excludes antennas. These concepts began to consolidate in the mid-nineteenth century, from the work of engineer Louis Sullivan, considered the father of skyscrapers. But it was only in 1961, when engineer Fazlur Khan created the concept of tubular structure that this type of building became widespread and, after that, the nomenclatures.

This model has made a new city, Dubai, part of the international tourism route. In the last 20 years, this type of construction has emerged as a trend in the Brazilian real estate market. Balneário Camboriú, a tourist paradise, has turned lemonade out of lemons – it has transformed the little space on its shore into enough water to justify the strong verticalization at increasingly higher levels. Aiming at the real estate market, the city reached another equal proportion: tourism. Today Balneário Camboriú is considered a national replica of the artificial city of Dubai, attracting many visitors due to its *exclusive* skyline.

This upward growth in Brazil began in 1929, with the construction of the Martinelli Building in São Paulo, which soon became an architectural icon of its time. It was only in 1965 that it was surpassed by the 170 m Mirante do Vale, located in the center of the capital of São Paulo, which in turn was only surpassed in 2014, by the Millenium building. The tallest building in São Paulo will be the corporate tower of the Alto das Nações complex with 219 meters.

But other Brazilian cities are starting to race to compete in this *ranking*. This is the case of Itapema, in Santa Catarina, which will have the Charles II Yacht Royal Home, with 252 m, and Rondonópolis, with the Niraj Towers, 250.1 m, in addition to a residential complex in João Pessoa, capital of Paraíba.

Despite the exceptional cases of tall or mega tall buildings, the importance is in the range of undertakings above 150 m which points to a trend towards greater use of urban land, which, in turn, requires the improvement of national engineering, starting with the projects, passing through the materials, construction processes, standards, labor, in addition to a new vision of the market for each agent involved.

TQSNews asked some questions to some of the most renowned structural engineers in the country, who have already worked or are working on projects of this size. In alphabetical order: Antônio Stramandinoli Ju-nior; Augusto Guimarães Pedreira de Freitas; Aurélio Franceschi; Eduardo Both; Ênio Canavello Barbosa; Luiz Aurélio Fortes da Silva e Ricardo Leo-poldo e Silva França. The experts address in their article's issues related to the change in the Brazilian architectural scenario, technical aspects related to engineering, architecture, materials, equipment, safety and standards for the feasibility of a tall building.

Among the common points that they highlighted is the need for each professional to prepare to work in this segment in a specific way based on good professional training. They also highlight the critical points of the project, such as tests on the action of the winds and the rigidity of the structure. Updating standards is a permanent process. For this, the role of entities such as Abece (Brazilian Association of Structural Engineering and Consulting) is fundamental, in addition to the constant updating of computational technological tools.

Learning in this field, like tall buildings, has no limit. Happy reading!

Balanced solutions, perfect decisions

By Eng. Antônio Stramandinoli Junior
Master's degree in civil engineering from the Pontifical Catholic University of Rio de Janeiro, PUC-RJ, Brasil, managing partner of Kalkulo Structural Projects, working on studies and engineering projects in the area of reinforced concrete and steel building structures. Professor at the Federal University of Paraná (UFPR) in the disciplines of Strength of Materials, Building Structures and Reinforced Concrete Complements III.

Although height helps to define a tall building, it is not the main factor in defining a building as tall or mega tall. Slenderness is what best indicates whether the structure should be designed, mainly considering the dynamic effects of the wind, the soil-structure inter-ration and the effects of the construction stages. Slimness can be defined as the ratio between the height of the tower and the smallest size of its floor plan.

Technological advancement has redefined the limits of architecture in height. This progression is due to the synergy between high-performance materials and increasingly elaborate computational tools. Metal structures have always been present in tall buildings, such as the Empire State Building in New York. More recently, concrete has had a great advance in its mechanical properties, culminating in the emergence of CAD (high performance concrete), with resistance to compression fck, up to 1,000 Mpa, a factor that made its wide use in tall and supertall buildings feasible.

There are some main issues to be considered to increase the height of buildings, especially in Brazil, where this wave is only beginning. It is very important to change the way projects are contracted. The architect, the engineer responsible for the structural design, as well as the dinamic consultant, if applicable, must start the studies of the building at the same starting point. For tall buildings, the shape of the geometry in the tower plan, as well as the geometry along the height, can contribute greatly to the minimization of the dynamic effects of the wind. This preliminary study is carried out with the help of wind tunnel tests. Preliminary studies of hydraulic, electrical, air conditioning, elevators, gas, etc. projects should also be initiated.

The structural project must be prepared considering the dynamic effects of the wind, the dynamic effects of earthquakes, the soil-structure interaction, the physical and geometric nonlinearities and the consideration of the construction stages in the calculation of the forces of all the elements that are part of the structure.

The trajectory of our office, Kalkulo Projetos Estruturas Ltda, in Balneário Camboriú (SC) has been consolidated since the mid-1980s. Kalkulo was responsible for the structural projects of the two largest construction companies in the city, following their evolution from small buildings to high-standard enterprises. One of the first buildings, considered tall, for which Kalkulo developed the structural project was the **Sky Tower**, completed in 2016 by FG Empreendimen-tos, in Balneário Camboriú (SC). It is 122 m heights, has 40 floors and its slenderness is 12. The structure of the floors was defined with ribbed slabs in reinforced and prestressed concrete. The peripheral beams with larger spans were designed in prestressed concrete. In the front region, it has a 5-metre-long overhang. The wind tunnel tests were carried out by BRE, a company located near London. The horizontal travel limits at the top, as well as the comfort conditions of the occupants of the last pavilions, met the criteria of international standards.

Next, we designed the structure of the **Magnifique Tower** also built by FG Empreendimentos in Balneário Camboriú. It has a height of 149 meters and consists

by 48 floors and its slenderness is 10. The structure of the standard floor was defined in ribbed slab, filled with ceramic bricks and all of it is in reinforced concrete. This tower was completed in 2018.

Also from FG, we worked on the structure of the **Blue Coast Tower,** which has a height of 152 meters, 48 floors and a slenderness equal to 11. To meet the occupant comfort criterion, it was necessary to have a large mass located at the top of the building, which was defined by the dynamic consultant. It was located on the floor of the engine room, which was 1.65 meters thick. The slab was defined as 50 cm thick and the concrete infill as 115 cm thick.

We recently completed the structural design of the **Sapphire Tower** also from FG. It is a building 190 meters high, with 55 pavilions and its slenderness is 15. The structure was designed in reinforced concrete, all the slabs are soft, and the external walls are made of reinforced concrete. The tests in wind tunnel were carried out by RWDI

company located in Florida, USA and the dynamics consultant was Eng. Fatih Yalniz, from the company Tall Solutions.

For the construction company Procave Em-preendimentos we developed the structural project of Fischer **'s Dreams Residence Club** with two residential towers, the tallest of which is 181 meters high, has 55 floors and its slenderness is equal to 8.5. We also prepared the structural project of **the Apice Garden Towers** of the construction company RV Empreendimentos, consisting of two towers that are 191 meters high, 58 floors and slender equal to 10.5.

For AG7 Reality in Curitiba, we designed the structural design of the **Age360 building** with 36 panels at a height of 130 meters, with a slenderness equal to 8. Also in Curitiba, for GT Building, we developed the structural project of the **Oás Building**, which is being built by Thá Engenharia. It is 173 m heights, has 57 floors (3 basements) and its slenderness is equal to 13.

For high-rise building projects, the technical domain must be accompanied by proven practical experience and full knowledge of current standards (such as NBR 6118:2023, NBR 6123:2023, NBR 6120:2019, NBR 8681:2025, NBR 15200:2020 etc.). In addition to the former technical expertise, the analytical capacity to interpret complex models, the ability to work in a multidisciplinary team and the academic humility to seek advice from experts in highly complex topics are essential. Reaching the "state of the art" requires continuing education. This involves the mastery of *advanced* modeling software (finite elements and BIM), the constant monitoring of scientific articles, participation in industry congresses, and the study of new materials and construction techniques that improve structural performance.

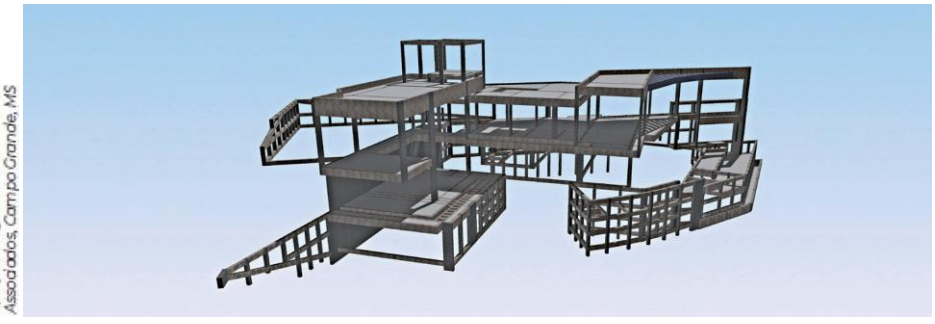
From the point of view of structural design, we can summarize the critical points in a high-rise building project as follows:

1. For an efficient solution, architectural and structural projects must be developed concurrently. The geometrics of the plant and the variation of the shape along the height (aerodynamics) are decisive to minimize wind loads. These studies, often validated by wind tunnel tests, should take place in the early stages.
2. Another crucial challenge is occupant comfort (excessive acceleration), which is part of the FSA's checks. In towers with great height and slenderness, isolated structural stiffness may not be sufficient, requiring the use of auxiliary energy dissipation systems, such as the tuned mass damper (TMD).
3. Due to the vertically huge loads and wind-generated bending moments at the base, foundation design is critical. It is necessary to have strict control of differential settlements, which can cause significant secondary stresses in the substructure, requiring advanced mathematical models of soil-structure interaction.
4. The consideration of constructive effects is crucial in high-rise building projects. While the classic model applies the full load on a finished structure, the construction in stages causes the lower floors to undergo deformations before the completion of the upper levels. This condition alters the redistribution of efforts and must be implemented in the structural model for greater accuracy of the results.

The main safety requirements are governed by the standards of performance and structural calculation, based on the ultimate limit state (ELU) checks, which guarantees safety against collapse, and service limit state (ELS), which ensures functionality and comfort (control of cracks, deformations and vibrations). As for height, there is no "prohibitive" fixed limit, but rather technical and economic constraints, which we highlight below:

- Slenderness: The ratio between the height and the smallest dimension of the base defines the building's sensitivity to the wind. The slenderer it is, the more difficult it is to meet the criteria of dynamic comfort (excessive accelerations that cause discomfort to the occupants).
- Material technology: The threshold is often imposed by the pumping capacity of concrete. Currently, the record is 606 meters (Burj Khalifa). Higher heights require "re-pumping" stations or new material technologies.
- Damping systems: Conventional designs have a technical feasibility ceiling; To overcome it and ensure stability without excessively increasing the section of the columns, the use of shock absorbers, such as those with tuned mass (TMD)).

My central advice to the entrepreneur is: understand that gaining visibility from a tall building comes with increasing technical and financial complexity. In short: the market differential is real and powerful, but it is only profitable if it is based on rigorous technical excellence and a team that master's the particularities of high verticalization.



Epr gjeto Engenheiros Associados, Campo Grande, MS

Attention to the smallest details (and cost)

By Eng. Augusto Guimarães Pedreira de Freitas
Civil Engineer graduated in 1988, owner of the Onyx Quarry, with extensive experience in precast structures, especially in load-bearing panels, having coordinated the regulatory process of the NBR 16475:2017 standard.

The trend of tall buildings in Brazil, in my view, is an irreversible truth, especially in very dense regions. The land is already being evaluated with this constructive potential, which makes it very difficult to make it feasible with lower buildings. For me, however, entrepreneurs have not yet understood that costs do not have a linear growth from a certain height, starting to have an exponential growth not only in structure, but also in frames, elevators, hydraulic systems mainly. This can result in compromised viability from a certain point.

I understand that Brazil has advanced engineering to meet this new demand. We have come a long way in recent years. Obviously, consultancies and exchanges of experiences with designers from other countries may be necessary, to gain knowledge and follow evolutions, since engineering has evolved very fast and with new technologies around the world.

It is not possible to draw a comparison between this type of building and a large infrastructure work, but I would say that the difficulties are in different points. In the high-rise building, our main complement is the guarantee of comfort in the limited state of service, evaluating the structure with the wind forces and verifying its dynamic behavior. Another point that requires much analysis is the foundations due to the great efforts concentrated in an area of small projection. Infrastructure projects can also be complex in terms of wind (especially in bridges), but the main complexity lies in the great efforts and spans that are required.

We have some works that we consider relevant from various points of view, such as Senna Tower, currently under construction in the city of Balneário Camboriú (SC). But there are many other examples

of buildings not with the same height, but already in situations where dynamic analysis has an important relevance. In this analysis, we have buildings with great slenderness that fit into this new scenario of the country today.

But to be quite honest, I think that a project with such characteristics does not add much to a city like São Paulo, which does not have ideal urban mobility to receive this densification. It is from a city where there is still a strong dependence on cars and the densification of very tall buildings would only increase the transport problem. We have already been following a very large density in recent years, even with buildings that are not so tall, with harmful effects on traffic. Taller buildings should only further impact this situation.

Cities like Dubai are not examples for Brazil, in my opinion. Dubai is not concerned about cost, which makes any construction "viable". In our country, cost and feasibility will always be relevant. In Dubai, despite the very tall buildings, there is no densification.

In very tall buildings, in addition to the logistical issue is the way the material is transported at great heights, and which can be one of the most critical points of the work, it is essential to have a greater precision of execution, after all, the plumb tolerances need to be reduced avoiding large horizontal displacements.

In some of our projects, to seek this reduction in tolerance, we used a variant of the concrete wall system, executing the wall panels with aluminum forms and the Gang execution system.

Other technologies that have advanced a lot are those for the execution of deep piles and concrete traces that allow pumping at great heights with high resistances.

We have studied the feasibility of using prefabricated facades in high-rise buildings, reducing the façade execution time and reducing the possibilities of pathology, which is very relevant today in this type of building. For this, we partnered with a Brazilian engineer who has been in Canada since 2019 designing and working with this technology.

Very tall buildings require wind tunnel testing to better understand how the structure responds to horizontal forces, especially in dynamic analyses. Since these tests do not provide absolute results, the data must be carefully evaluated and, when necessary, checked with additional tests to validate the team's conclusions.

I think the greatest care is the way of facing the "next floor".In very tall buildings, we move from a "linear growth of dimensions and problems" to an exponential growth. When we have 20 floors and add one, we can estimate (simplistically) that the cost and problems have increased by 5%; When we have a 50-story building and add one, the problems and cost increase much more than the 2% (which would be if it were linear) and can even

make the structure unfeasible. Any change in the variable in a very tall building can result in a loss of economic or even technical viability. So, it is necessary to pay attention to the smallest details of the project and execution to obtain a performance that corresponds to the gigantic challenge of this type of work.

The search for greater knowledge is necessity for everyone involved, whether designers, materials technologists are responsible for wind tunnel testing. For example, we chose to carry out these trials outside Brazil. I believe that all of us, professionals, need to seek knowledge in structures of any type. We have an evolution faster of new technologies and materials the require us to constantly search for knowledge. This can be done through seminars, congresses and research papers published in different countries as sources of knowledge. Another way to acquire knowledge is to participate in technical missions to exchange experiences with professionals from other states (why not?) or countries. After all, we always think better and evolve more consistently when we are in a group. That's what we've been doing and it's worked.

An act of courage

By Eng. Aurélio Franceschi
Founding partner of AS Estruturas Engenheiros Associados, civil engineer from the Federal University of Paraná (UFPR) in 1987, professor at IDD – Daher and De Luca Institute; he has taught at PUC-PR and UFPR.

What defines a tall building is not only its height, but the slenderness of the structure, which is defined by the ratio between height and smallest width. The arrangement of the columns in relation to slenderness also affects this classification.

With the construction of the Senna Tower building, which is at the beginning of construction in Santa Catarina, which should be the tallest residential in the world, Brazil is preparing to have a world icon in terms of the architecture on tall buildings. But the truth is that there are already more than hundreds of tall buildings in our country, which shows that Brazil has a culture for constructions the exceed the common height limits.

One of the most important factors in a project is the choice of the best or most appropriate construction processes. These are decisions that involve all the agents of an enterprise and will be the basis for the efficiency of this structure. This integration begins with the joint work between "structure x architecture", in joint and synergistic work with the execution team of the work, which will perpetuate the master column that can reach 300, 400, 500 meters or even higher. The other projects, in turn, should also follow this logic of sharing information and/or decisions.

But there is another factor that also acts in a project like this. Balneário Camboriú has become the epicenter of this trend in the country, thanks to the initiative and courage of the entrepreneurs and the release of construction parameters by the municipality.

Not everything is rosy. We have seen images on the internet of buildings with swimming pools swaying in the wind. There are many truths behind these images. Because in other times not too long ago, back in 2010, designers with technical capacity were not hired to design them, or appropriate techniques were not used to meet the precepts of wind engineering, and thus engineering was unsuccessful.

After the occurrence of some cases of "it wobbles, but it doesn't fall", entrepreneurs invested in specialized professionals and wind tunnel tests. And today we have more assertiveness to avoid this discomfort. A building should indeed sway, but within limits considered reasonable.

With respect to the standards, we can say that they have undergone recent revisions that meet many needs of high-rise buildings, but it is still necessary to advance in some points.

On the other hand, today we have the support of Artificial Intelligence (AI) to speed up many tasks, but personally more is attributed to the analytical capacity of a human than the results of research and results of AI.

Personally, what I can recommend to the new generations that are coming to the market in this new scenario is: study hard! And have the courage to show customers the real needs of the project. They do not surrender to requests that are not necessary just to make a contract. And do a good job!

Obsession with the result

By eng. Eduardo Both
Graduated in Civil Engineering from the Federal University of Rio Grande do Sul (UFRGS), with specialization in structures and tall buildings; PMD – Program for Management Development, ISE/Iese (São Paulo/Barcelona).

I believe that tall buildings have attracted me since I was a child. At this time, he was already trying to build them with higher cards. As an undergraduate, I attended the only elective course available on the subject. In the first month after graduation (2003), I modeled the World Trade Center to see the structural parameters of buildings of this magnitude. In the first office I worked for (Projetak de Porto Alegre) I always tried to participate in the projects of taller buildings.

In 2012, I participated in the design of my first tall buildings: one of 152 m and another of 175 m high, both in Balneário Camboriú.

What is needed to operate in this segment? I believe that it depends on the degree of demand that the professional imposes on himself. To offer a solution that meets safety and performance standards and to understand the concepts of structural engineering applied to tall buildings, taking a specialization on the subject at a prestigious university is a good start.

On the other hand, if you want to achieve a solution that has performance and efficiency among the top 10% of the world, you will need to go further and be obsessive in the subject study, analyzing dozens of tall buildings already built, evaluating the "secrets" behind the efficient solutions. It is also recommended to seek out the best professionals on the subject and learn from them.

Another relevant point in tall buildings is that it is very worthwhile to do exhaustive tests of different solutions until you find one that is efficient. If in a normal building the structure is already the most expensive item of the work, in a tall building, the structure represents an even greater proportion. One detail

It can mean millions of reais in cost, not to mention the waste of resources and environmental responsibility issues.

It is a challenge and a collective work, without a doubt. It should involve all co-workers, to exchange ideas and experiences about solutions, in addition to the project team itself. One of the main synergies that must occur is with the architect.

In a tall building, the efficiency of the structure is dramatically influenced by architectural design. It is important to exchange "stickers" between the architect and the calculator from the initial conception of the architecture. Other experts that should be consulted from the outset are dynamics analysis and wind tunnel testing, as they anticipate potential problems and avoid wasting unnecessary time and costs.

I try to say the following: "if we follow this path, the repercussion is this and the cost is this; we have these two alternatives, with these repercussions and these costs". This usually works and makes the decision-making process objective. I believe that the ideal is for the engineer, the architect and the entrepreneur to work as partners, because the objective is the same, making a spectacular work to happen. Each one enters with their knowledge about the challenge that is in front of them and together they will try to reach the optimal point for the undertaking. Generally, in a tall building, architectural and structural conceptions must be developed together, due to their mutual interference.

Recently I participated in the Petra Tower project, the current tallest building in Paraguay, with 172 m high and 44 floors. It is a conventional reinforced concrete and prestressed flat slab. The biggest technical challenge was with respect to the wind, for two reasons: it is more intense in the region and has few obstacles (the surroundings of the building are basically formed by houses). With this, it was essential to design a structure with high rigidity to minimize the dynamic effects of the wind. This was possible by creating concrete mesh panels that connect the core to the columns of the façade. These walls start on the floor of the first floor and are interrupted on the leisure floors that exist along the height of the tower, avoiding conflicts with the architecture. The higher rigidity limited the effects of wind and resulted in a structure with good technical/economic performance, achieving a high degree in our structural efficiency seal.

On the issue of the safety of a tall building, I think it is important for you to keep things simple. The operation of the structure must be visually clear and easy to model. Complexity creates uncertainties that can affect security. Another point worth paying attention to is stiffness. Greater stiffness can contribute not only to safety, reducing dynamic effects that are difficult to predict, but to the feeling of security, minimizing the perception that the building is moving. In terms of

prerequisite, the most relevant thing is to follow the national normative standards (and international when eventually the NBR does not contemplate).

The bottleneck in a high-rise building is usually not safety, but comfort performance. For example, minimizing the possibility of building users feeling the building "shaking", or overflowing swimming pools, etc. For this there are also parameters to be followed. The challenge is to meet the parameters with the most efficient structure possible.

There is today, in my view, a relevant effort to evolve knowledge and technology in tall buildings in Brazil. But I believe that the country can evolve more quickly by allowing the construction of tall and super-tall buildings in large centers, such as São Paulo, which would greatly accelerate the development of this sector in Brazil. São Paulo did this with medium-sized buildings, where it created, through the construction of thousands of buildings, a *know-how* that is difficult to achieve elsewhere in the world.

The region of Balneário Camboriú has been leading this trend for a long time, but its speed is limited to the size of its market and does not have the infrastructure that a huge urban center naturally has. I believe that the construction entrepreneurs of the coast of Santa Catarina can be considered heroes with what they can do in relatively small cities.

And we see that there is a wave of high-rise building projects happening in various regions of Brazil, largely motivated by the examples coming from Balneá-Rio Camboriú. If the country's economy is doing well, this movement should accelerate in the coming years. This would create the basis for us to enter the sector of supertall buildings (over 300 m high), which have their own challenges. That's what I hope will happen! To reach a new evolutionary phase of the Brazilian market, I would make three recommendations to the national market:

1. allow the construction of tall buildings in large centers, as already mentioned;
2. disseminate specialized knowledge of structures of tall (and not only tall) buildings around Brazil; we still have many technical islands;
3. create metrics that allow evaluation of the technical and economic performance of structural solutions; which not only reduces the waste of resources but also highlights and values the most qualified professionals.

For my part, I am working now almost entirely dedicated to the implementation of items 2 and 3 through Zücken. And I believe that this can be a legacy for the development of this segment.

To this end, I was proud to work on the development of the Zücken seal, a tool that evaluated the technical-economic efficiency of building structures (including tall buildings), allowing the optimization of costs and performance, reduction of waste of materials and less environmental impact, contributing to a more sustainable civil construction.

Prior to Zücken, I worked as an author or co-author in structural projects in 25 Brazilian states and abroad, totaling 716 works and more than 14 million m² built. Among the projects I participated in, I highlight the Athletes' Village – Rio 2016 Olympic Games; HUB – in Curitiba; Autentic, in Belém; Titanium Tower, New York Apartments, and Serendipity – in Balne-ário Camboriú; and Petra Tower – in Paraguay. There is no mystery. The rule is to make it happen!

PROJETA Engenharia, Marília, SP

Path of no return

By eng. Enio Canavello Barbosa
Graduated in the class of 1981 from the Mauá School of Engineering, managing partner since 1987 of Edatec Engenharia Ltda, former president of Abece, 2020-2022 management.

I believe that the important factor for Brazil, when receiving projects of this size (tall or mega tall buildings), is a new *technological* ranking, positioning itself alongside other countries that develop projects of this size, both in the architectural, structural and other building systems. For the construction of these enterprises, there is a complex coordination with the team of architects, engineers, builders, equipment for the execution of the foundation, rental of cranes, concrete towers, shoring, etc., enriching the civil construction industry.

We are following significant changes in the sector. For example, the CTBUH (Council on Tall Building and Urban Habitat), founded in 1969 with thousands of members, began to have the Brazil chapter. In São Paulo, the Altino Arantes building with a height of 161 m (year 1947), the Italy building with a height of 165 m (year 1965) and the Zarzur palace with 170 m (year 1967) were, the tallest in the city.

In 2021/2022, the construction company Porte built the Residencial Figueira with 168 m and later the Platina 220 with 172 m. Currently we have the Global Park with 174 m, and Alto das Nações, with 219 m, in addition to others still in design.

This movement brings great changes to Structural Engineering from now on, both for structural engineers and for part of the companies that make the *software* available. There is an awareness of sustainability both in the use of the building and in the structural solution to meet international certifications with LEED, Aqua, Edge, Well, etc. We also have the diffusion of knowledge around structural dynamics as modes of vibration, modal analysis, user comfort, wind action, etc.

Our technical standards tend to follow this movement and there is a need to evolve in national prescriptions regarding the Technical Instructions of the Fire Department, as each state has different perspectives on issues of escape routes, *sprinkler* systems, stairway presurization, refuge areas and other items. In São Paulo, for example, towers above 150 meters must be analyzed by a technical commission; Other states have other rules. We need to have a national consensus on this.

In this purpose, Abece (Brazilian Association of Engineering and Consulting) is always innovating both in the revisions of ABNT standards, as well as in alignment with the ACI (American Concrete Institute) and Fib Model Code. Note that the Brazilian contribution to the FIB made the engineer Íria Lìcia Oliva Doniak become the president of this organization for the 2025-2026 term.

I also highlight that Abece has the interest in disseminating knowledge, whether through publications, such as volumes I and II in partnership with Ibracon (Brazilian Institute of Concrete), as well as the various recommendations prepared to improve the projects, especially the guidelines for the use of CA-70 steel.

I believe that another point to be highlighted in this scenario is the interaction between designers and builders. Our scope was focused on the project, not having the builder as a participant to help in the operational part. Due to the large number of floors and the extended deadline for execution, it is salutary to discuss the project decisions with the executor.

For example, use of pre-
- Manufactured design. They can be lifted by the crane, there is a load capacity to ascend them, there is operational capacity in the concreting cycle of the pavements. These questions must be agreed with the executor to make it feasible to design precast stairs.

There is a demand for the evolution of concrete with strength and larger elasticity modules, high-pressure concrete pumps, standardization of tests in wind tunnels, fire safety systems, etc. At the end of last year, Abece, with the coordination of Prof. Sérgio Hampshire, published by ABNT (Brazilian Association of Technical Standards) the new NBR 8681:2025 – Action and safety in structures – Procedure updating the 2003 version responding to this issue.

This is a path of no return for Brazilian Engineering. High land prices or lack of land force cities to densify. The point is that the municipal code must change the concept of limits in ventilation, insolation, setbacks for integration with the surroundings to have urban planning focused on the location and not on generic zoning parameters.

Thus, by elaborating a specific urban plan, these guidelines lead to a transfer of constructive potential between preservation areas and verticalization zones. In this way, there is a concentration of higher buildings and benefits for the surrounding areas.

Brazil is entering a new era of structural engineering, without a doubt. Tall building projects are not just architectural landmarks, but catalysts for innovation in standards, materials, *software,* and constructive practices. But it is worth remembering the phrase of engineer Fernando Stucchi in an interview with Abece magazine, March 12, 2023 edition: "in the effort to expand and modernize the standards, we have to be careful not to lose the advantages in more than 120 years of experience".

Criative instinct

By Eng. Luiz Aurélio Fortes da Silva
Civil engineer graduated in 1983 from the School of Engineering of Volta Redonda, Partner of SIS Engenharia, he was an instructor at TQS Informática Ltda between 1994 and 2012, taught more than 100 courses on the design of prestressed concrete structures using the CAD/TQS system in various locations in the country. - Member of the board of directors of Abece since 2015, he held the presidency in the 2024/2025 term.

Since the 1980s, computer technology has been developing tools that allow engineers to design taller and taller buildings, with all the considerations and best techniques available on the world stage. However, once, in the 1990s, I heard in a very striking lecture by Professor Mário Franco, perhaps the most renowned Brazilian professional at the time, that "we are still not in a position to design using only space frames".

This phrase was for all of us, at that time, especially for Eng. Nelson Covas, a stimulus factor for the development of new tools and, after only a few years, we were able to put together a package of programs that allowed engineers to start designing integrally with a space gantry. At the same time, the interface with the results of the wind tunnel tests would appear. In this way, the designers began to have a processing system that fully allowed them to design structures with the results of a spatial gantry. Professor Mario Franco certainly followed with satisfaction this advance in computer systems.

This innovation made many engineers lose their fear of designing tall buildings, which, at the time, were not as tall compared to those that are currently being designed in Brazil. In the 1990s, the largest

building designed in São Paulo was 165 meters long. In all of Brazil, there was no new tall building being designed since the Mirante do Vale, with 170 meters, which is in the Anhangabaú valley, whose construction dates to the early 1960s.

It is worth mentioning that there were already powerful programs for structural analysis and effort acquisition, such as SAP2000®, Ansys®, GTStrudl®, Strap®. But these programs were not integrated, starting the structural laying as forms launched floor by floor, going through structural analysis, obtaining efforts, dimensioning of hard reinforcements, generation of reinforcement drawings until we arrived at the plotted plans. The systems of TQS and some other companies directed their development for this integration.

We can say that, even in the late 1990s, users of TQS systems already had a sufficient tool to design tall buildings with quality. In the mid-2000s, the integrated gantry model emerged, considering the slabs as an integral part of the spatial gantry models. It was a new technical leap towards the interpretation of the most real behavior of structures and the achievement of very precise acting efforts. It is worth noting that integrated models are very important for buildings with flat and prestressed slabs.

They were certainly important milestones that reflected on the evolution of Brazilian computational structural engineering.

In parallel, since the 1990s, technical solutions have emerged that allowed the design of foundations with greater capacities. We can mention, for example, continuous helix piles, excavated piles, systems such as diaphragm walls, barcap piles, in addition to metal piles that have also become more common, although they are not very common nowadays.

Today there is equipment that enables the application of high-capacity piles, minimizing the risk of settlement. And with that, the structures are formed by

superstructure and infrastructure have the possibility of forming joints with rigidities far superior to those that existed 30 years ago.

There have also been many advances in concrete technology and its production resources, allowing it to reach high strengths, as is currently achieved. At the end of the 1990s, the conventional were structures that used concrete with usual strengths of 30 MPa to 50 MPa (usually applied to columns). A milestone was the experiment of using 122 MPa concrete in the e-Tower building. Today we can already see the use of concrete with strengths of up to 90 MPa.

We also have much more powerful shoring systems, much more consistent forms, including aluminum that allow optimal use and, in addition, we have many types of ribbed slab molds.

The appearance of greased strands in 1996 in Brazil led to the popularization of the use of prestressing, with reflections for greater agility in the construction songs. In relation to conventional steel, after more than 50 years very well served by steels of the CA-50 and CA-60 grades, CA-70 steel was recently launched, with a strength 40% higher than CA-50 steel and with similar characteristics, which has already allowed us to optimize the number of bars, especially in large blocks of foundations.

Regarding wind actions on tall buildings, it is important to carry out wind tunnel tests. In the early 2000s, it was agreed that the results of the tests that represent the equivalent static forces would be "transcribed" into files formatted in three components (FX, FY and Mt), which made it more practical to insert these forces into TQS computer systems. In 2007, the dynamic analysis module was created, later the module based on the HFPI (*High frequency pressure integration* technique) and today we can elaborate the projects already considering the forces and dynamic amplifications that arise with the detachment of vortices and resonance effects that conventional static analyses did not capture.

Therefore, the current context allows us to design buildings of any size with great design concepts and tools.

Over these 30 years, urban changes have occurred. The mayors have been inserting changes in the construction templates, as occurred in Fortaleza, João Pessoa, Goiânia and Balneário Camboriú, encouraging and facilitating the verticalization of projects. In the city of São Paulo, there is a certain restriction due to airplane routes. But here we also have cases of buildings over 200 meters, such as the United Nations Palace, 225 m high, located on United Nations Avenue, in the south of São Paulo. In Palmas, Tocantins, a 224-meter building is being designed.

In the case of Balneário Camboriú, there was a real need for verticalization due to the lack of spaces, in addition to a demand in the market for high-standard options. As a result, the buildings grew, going from 30 to 40 floors, then 50 and even 60 floors, to the point that today there are several buildings that reach a height of 200 to 290 meters, already ready.

The first time I was in the region, in 2014, the projects were not yet very well prepared. One of the local companies was very well trained, forming a good project coordination team and hiring high-level professionals for the various specialties (architectural, structural, foundations, installations, fire, frames, etc.) to improve the overall quality of the structural projects. It was at that time that I was invited to do technical evaluations of projects for this large construction company. Then, we started to prepare the projects and today SIS Engenharia already has five projects of tall buildings made for the same construction company from Balneário Camboriú and all exceeding 200 meters in height.

In the most recent one, already known as Casa Armani, which will reach 292 meters in height, we were hired to carry out the entire structural design phase until reaching the preliminary design phase. Now we move on to models and other data for the executive phase that will be carried out by the Pedreira Onix, whose owners are Augusto Pedreira de Freitas and Maurício Pires. From this point on, SIS will carry out the technical evaluation of the project.

It is important to highlight that the designers must evaluate the availability and quality of the local aggregates, which will influence the characteristics of the concrete. In Balneário Camboriú, from 2015 until now, I used a maximum of 50 MPa concrete because we do not have greater modulus of elasticity above this strength, due to the type of local aggregates. In Casa Armani we will have to use concrete from 45 to 80 Mpa, possibly using other sources of aggregation and differentiated traces.

Another interesting point is that, in the last 20 years, there have been important changes in the design premises in relation to acoustics and fire situations. For example, recently, the Santa Catarina Fire Department brought the requirement to create refuge zones for greater safety of users in the event of a fire. In this 292-meter-high project there will be three refuge pavilions.

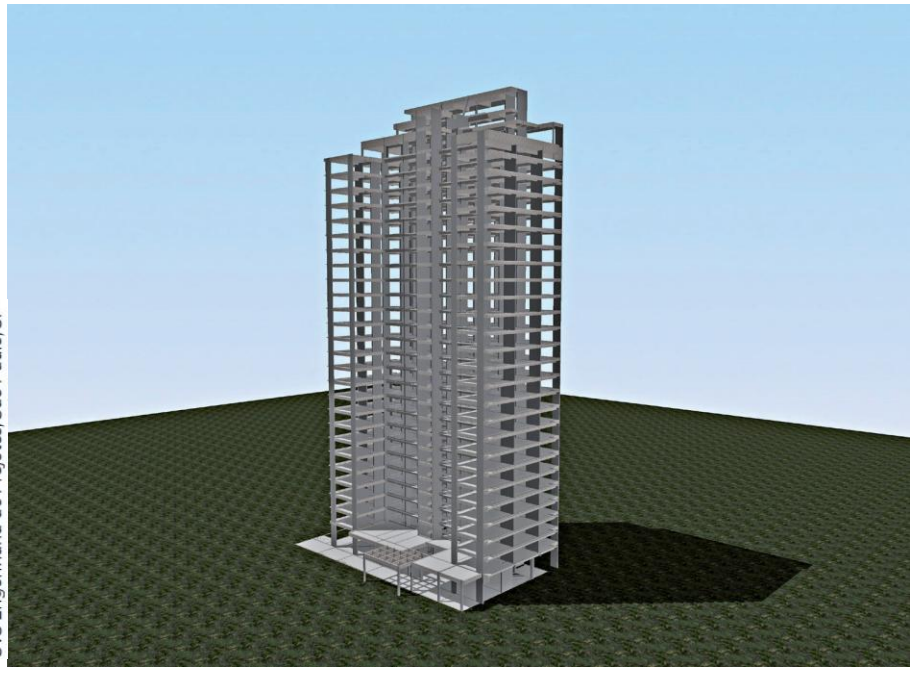
These are just a few examples of the specificity of these projects. That is why I emphasize that good engineering requires an engineering and engineering team that acts in total harmony. Ideally, during design and development, the best solution should be studied until a structure of good rigidity is found. This will guide the entire feasibility study of the project. And the next step is to take this solution to a trial

of wind tunnel and dynamic analysis and then verify if the structural model can resist the maximum forces in ELU and meet the ELS parameters, avoiding discomfort in cases of very strong winds, as we have already seen in videos circulating on the internet. The good designer has in mind that the structure must have the ideal rigidity to meet all these premises, including, depending on the structural and architectural changes that occur throughout the development of a project, it may be necessary to carry out a second wind test with the final structure defined to reassess the dynamic behavior and obtain new acting efforts.

There is also the classic slenderness index of a structure, which would be the height/width ratio in plan. In Balneário Camboriú we already have buildings ready 168 meters high with only 9.5 meters wide. This relationship of slenderness directly influences structural design, in the search for global rigidity that meets the good requirements in relation to global stability and comfort. The PNU, United Nations Palace, the largest building in São Paulo, is 225 m high with 54 m of extension in plan, that is, it is a building with low slenderness; The distances between columns are enough to form good lever arms in the fight against wind actions.

In the analysis we carried out, we observed that a building of 200 meters must have a rigidity five times greater than a building of 133 meters. And that the rigidity of a 300-meter building must be five times the rigidity of a 200-meter building. The stiffness of a 500-meter building must be 7.7 times greater than the stiffness of a 300-meter building, or 39 times the stiffness of a 200-meter building. In a simpler way: the set of columns, beams and slabs, which form the rigidity set of a building, must be much more rigid according to the height of the building, in a non-linear way, because slenderness and differentiated architecture do not allow us to establish rules for pre-structural launch.

In one of the buildings we designed, we used the structural design technique considering three *outriggers* along the height of the building. In other words, we have three floors with walls in the structures that are connected by columns that will work with traction and compression when strong gusts of wind occur. We achieved an overall stiffness gain close to 13%.



SVS Engenharia de Projetos, São Paulo, SP

Regarding foundations, in the case of tall buildings, it is important that there are no considerable deformations /settlements throughout the useful life.

Ideally, the piles should run up to the inseparable layer of soil. In our coastal cities and in the Midwest, the poor quality of the first layers of soil requires the use of stakes from 30 to 58 meters deep, to reach the resistant or impenetrable layers of soil.

Designers need to be aware of many concepts and premises to design high-rise buildings. There is no specific course to prepare an engineer for this challenge. And in my opinion, it shouldn't even exist. The design professional must accumulate experience until he can design a building of this size. And there is nothing better than this professional employing the right tools that are available on the market.

In this regard, I warn you: those who have adhered to the TQS system must be able to understand the functioning of the structural set as a whole and locally as well and know how to interpret the results obtained in the spatial gantry models, as well as detect any failures in modeling. Anyone can make mistakes when studying the design of a structure, but few can see these moments as flashes for learning and seeking to evolve.

I was fortunate to teach TQS system courses to renowned Brazilian engineers between 1995 and 2003. Sometimes I heard "I had never thought about it", that is, they were open to knowledge. By teaching introductory courses on the use of spatial gantry, analysis by grid on the pavements, among other tools, I helped to take many engineers from the simplified calculations of continuous slabs and beams, starting to design spatial gantries in a commonplace. I feel vey fulfilled by this!

A great fear that always exists in our segment is that our structural engineering will not continue this evolution, because the new engineers supposedly would not have the same training as 30 years ago. In fact, 50 years ago, the structural engineer was required to have much more perception of calculation. But many were also limited to conventional structures due to the lack of tools to interpret the structures with the ease of the spatial gantry and grid visualizers, in addition to the various reports that are generated today with each global processing of the structure. In other words, today engineers have a much greater possibility of evolution than 30 years ago.

The important thing for a structure engineer, whether young or senior, it is to have the will and determination to design a structure with high levels of demand and assertiveness. This impetus is what leads an engineer to become a specialist in his area and makes him evolve over time as a professional. I have had the great pleasure of following new engineers to work at a high level and that old fear of the extinction of our class is fortunately not occurring.

Looking to the future, there will be an increasing need to consider reductions in CO2 emissions from civil construction in the coming years, and with this the sector will necessarily have to reassess the feasibility of constructing tall buildings in areas where the soil requires the application of large volume of concrete and steel in stations and large piles cap.

We can conclude that Brazilian structural engineering is capable of designing its tall buildings with quality and, many times, with superior quality to projects developed in other countries. We are experiencing a new cycle with the expansion of these projects, which bring a new architectural, technological, touristic component and with consequences for profitability. Some represent world brands, such as Pininfarina, Casa Armani, Lamborghini, Pors-che, which make them more remarkable.

Surely the fashion of tall buildings is here to stay! The message I want to leave here is: prepare
yourself! If you are a professional with this vocation, there is everything for you to grow right here in Brazil!

The path to a perfect project

By Eng. Ricardo Leopoldo e Silva França
Civil engineer, master and doctor from the Polytechnic School of the University of São Paulo (USP), where he works as a senior professor. Director of França & Associados Projetos Estruturas, he is a member of entities such as ACI, Fib, Iabse, Ibracon and Abece, and was a member of the revision committee of the ABNT NBR 6118:2003 standard. He has received several awards, such as the Emílio Baumgart Award (2001) and the Epaminondas Melo do Amaral Filho Award (2007), both from Ibracon, and the Structural Engineering Talent Award (Abece/Gerdau) in the Buildings categories.

Brazil has entered the radar of tall buildings, driven by the search for architectural, aesthetic and marketing differentials. Although I already work on projects of this size, I consider it important for society to participate in the discussion about its need and its impact on the urban landscape. A tall building requires the best possible solution, both from an engineering and architectural point of view.

When you oversee a project with such a characteristic, it is necessary to seek a line of reasoning that provides the best performance of the structure. In a tall building, one of the most critical issues is, the impact under the action of the winds. This is a very important effort for the (high) structure, as there are fewer phenomena in the interaction of the structure with the wind, which do not occur in lower buildings.

It is a phenomenon called the detachment of vortices, in which the wind forms eddies on one side and sometimes on the other side of the structure, inducing very high efforts and a possible strong oscillation of the structure. Another issue is the acceleration of the top of the building in relation to the unusual wind. Why? Any structure moves when it receives load. And the higher it is, the greater the load related to the wind. We have as a mandatory factor in this project the wind tunnel test; The sooner it is carried out, the better the understanding of the interaction between the structure and the wind.

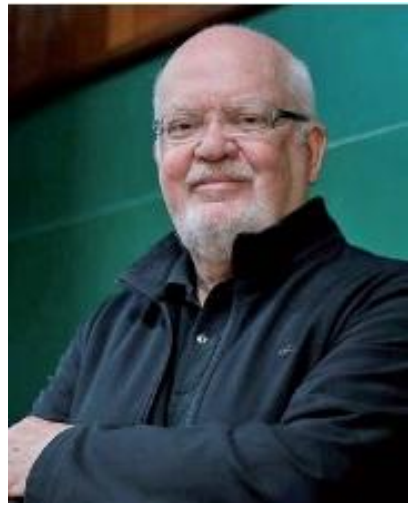
That is why we see, especially in other countries, buidings with different shapes, sometimes “twisted” in the

in the most common language. One of the reasons, in addition to the aesthetic differential, is that the architectural format seeks to reduce the effort imposed on the structure due to the wind. This factor considered critical leads to or can generate the need for more robust structures.

The higher the height of the building, the more rigid the structure will be, or the more full-bodied, because, otherwise, the user will feel uncomfortable or even nauseous on the day of a stronger wind. This does not indicate in any way that the structure is unsafe. But more sensitive people may have difficulty living in this building. So, to avoid this problem, wind tunnel tests are carried out, which will help to define the characteristics of the structural project.

Understanding this complex interaction of the wind with the structure is one more formation that the structural engineer needs to do so. The architect must think "what can I change in my way of conceiving to seek the best performance of the project?". In turn, the designer must be able to suggest modifications to reconcile the structural and architectural design. An exchange of views is necessary for a solution with adequate performance, without forgetting the limiting factor of costs. In my view, this dialogue is essential and should start with the conception of the entire enterprise.

Usually, the largest buildings in the world are made of concrete structures. It is not a whim, or because the professional does not "like" to use metal structures. In general, this system is only competitive when there is an urgency for the work to work. Is there an environment



conducive or not for the metal structure. But the trend towards the execution of new taller structures is really in reinforced concrete.

Something important is that we can currently count on the support of the Technical Design Assessment (ATP), a mandatory process in many circumstances, especially in a large project to check the applied premises, observe the current standards, the concepts adopted, among other factors, validating or not the prerequisites of the project. I consider it essential to insert the ATP from the conception of the project. These professionals could dialogue as follows: "I am conceiving the structure, I will consider these efforts, I will discretize the structure here, I will have a transition there." And receive as an answer: "Okay. We agree on these parameters", because there are several steps that can lead to a good or a bad result of the structural model

In the computational part, for example, there are a series of items that can contribute to the improvement of the project. Software – and I mention here the various TQS systems – allow you to model a building in various ways. It would be very

interesting that the calculator used a certain system to design while the ATP professional used another system to verify. Thus, the same design is modeled on different *software* platforms to compare results. There are characteristics suitable for each project that need to be diagnosed in time, and I believe that it would be a better and richer way to seek maximum performance of the structure, avoiding the need for future interventions or corrections.

In addition to the professional issue, we must think about the offer of specific services, products and materials for these projects. In my view, we need new technologies in relation to steel and concrete that absorb new processes, for example, with respect to formwork, with a focus on more agility. We are on a learning curve for some processes, no doubt. Construction needs to question where and how it can improve processes. How to good bear more efficiently and safely in the case of a high-rise building? How to produce this concrete? Is Brazil developing the technologies necessary to carry out these works? Because these are not conventional equipment, but they need to be developed. It is a gradual process. As the demands emerge, the solution is developed.

A very important professional in this scenario, in my view, is the consultant of concrete technology. He is the one who will advise on which type of concrete is the most suitable for each situation, so that the designer can design a solution with a view to the most suitable material. There are variations in both strength and consistency of this concrete, as well as its pumping logs, that need to be considered.

Suppliers are working on these issues. Increasingly the project involves more specialties, such as the projects of electrical installations and elevators, also considered critical areas in a project like this. Without a doubt, all items are very important and must be reviewed. There is also the need to develop and / or enhance some types of foundations to serve these buildings.

Brazil has the expertise to execute buildings 200 or 250 meters high. We have beautiful examples of buildings of this size in the country. But there are not many examples of buildings above 250 meters in height. In my opinion, in this case, it may be interesting to have the contribution of an international professional or office. It is fundamental to adding knowledge. We need to absorb technology that we don't know yet. It is a necessary step for Brazil to further master the system of construction of tall buildings.

For this, we need Brazilian professionals to be even more prepared. But there are several steps that must be completed. Academic training is undoubtedly the first of them. But real learning only happens in the field of work. A good structural engineer only completes his learning by working in a good office and acting directly on projects. Much of what is done in structural offices is unknown to academia. Real understanding of the dynamic response of buildings is only possible through practice.

All my life I have always lived on both sides, with one foot in the academic world and the other in the professional world, and I can secure this abyss. For my master's and doctoral students, I strongly reinforce that they work on projects. There is a lot of research needed to improve (calculation) engineering that only a person with practice can understand and take the issue to academia.

Many of these solutions end up being introduced to the market through regulatory standards. That is why the interaction between the academic world and the professional world is fundamental. You must merge the two worlds. This message is very important, especially for young people who are sometimes deceived by the issues of technology, artificial intelligence, the ease in various other fields. But in structural engineering they will have to go through all this learning.

The activity of structural engineering is certainly quite complete. It is one of the branches of engineering in which mathematics is used the most and requires a broad training course in several other disciplines as well. Some steps are important for those who want to train themselves to work in this segment. First, and this is a message to young professionals who are graduating: work in a good office for the first few years! The first stage for any engineer to think about designing a building of this type is precisely to have made projects for smaller buildings in addition, as I have already said, working in a good office.

Sometimes a young person thinks that learning to use a program is like learning a game. But it is not. Of all the programs available for this purpose, none is complete. The programs are improved to avoid errors, but there is a certain limitation. The professional needs to have a global view of the functioning of the structure. There are many young people who say, "oh I learned to use the program!" and have a false sense of power and co-knowledge. It is very dangerous because this professional can be induced to make mistakes with deficient, expensive or unsafe solutions.

Learning how to use a structural analysis program can make you a good operator, or programmer, but not a good structural engineer. To this end, continuous study is necessary. That is why I emphasize: the training of engineers must always be complemented. The fact that it is a tall building only adds more complications to the project. The challenge is doubled and certainly training is very important to meet this challenge. There is no way to jump steps. Seeking a good education, working in a project office, completing a master's or *stricto sensu* course, seeking coexistence and exchange with other professionals, assimilating new technologies, all these steps are crucial for those who want to become an outstanding professional in their area.

BIM: an honest look of those who design

By Engineer Marcel Cassandri Romero Farinha
Civil Engineer with a solid trajectory in structural engineering and project management using the BIM methodology. He also works in the academic sphere as an undergraduate and graduate professor, being a reference in the implementation and teaching of technologies applied to civil construction.
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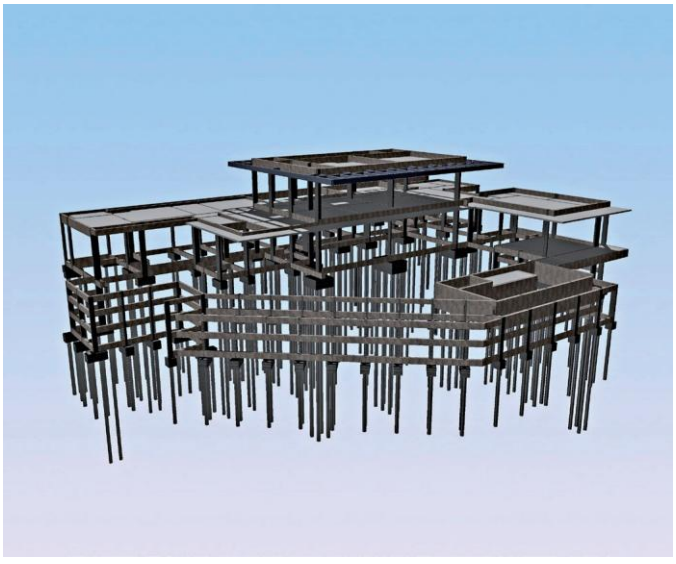
BIM arrived with the promise of revolutionizing engineering, but for many designers of concrete structures, the experience has been bittersweet. There was hype that brought with it a hasty and sometimes disqualified introduction to the methodology. Generic execution plans, excessive detailing requirements with no clear purpose, and a flood of parameters that no one consumes have turned what should be an oti-mization tool into a source of bureaucracy and rework.

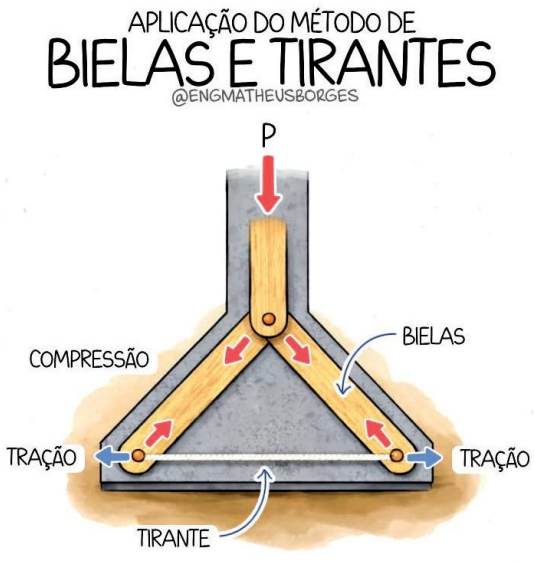


3D Model - Eng Marcel Cassandri Romero Farinha

It is not uncommon to find professionals who, after going through poorly managed projects under the BIM banner, boast of not using it. This aversion is understandable: when BIM is imposed without clarity of scope, without defined priorities and with demands for minutiae irrelevant to the project phase, it really becomes a burden. The problem, however, is not in the methodology itself, but in its misapplication that confuses volume of information with value, and detail with decision.

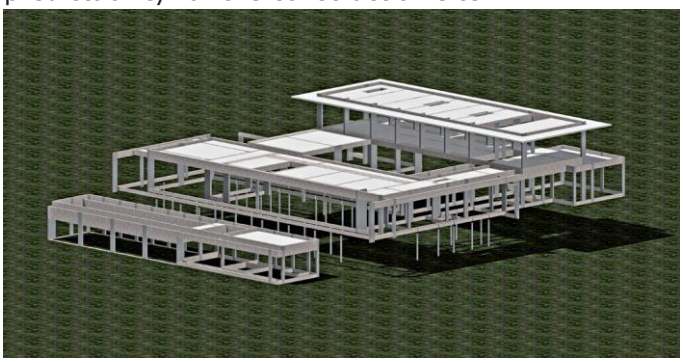
A well-defined structural model, with levels of detail appropriate to each phase (e.g., LOD 350 forms in the executive), allows you to identify and resolve critical conflicts before they become costly problems on site.

The true value of BIM for the concrete structure designer lies in very practical points: the ability to efficiently match structural design with architecture and installations (MEP), reliability in quantitative extraction, and precise control of holes and *inserts*. A well-defined structural model, with levels of detail appropriate to each phase (e.g., LOD 350 forms in the executive), makes it possible to identify and resolve critical conflicts before they become costly problems on site. This means fewer holes-in-place in



Eng. Matheus Borges

beams, less improbation in slabs and more predictability for the construction site.

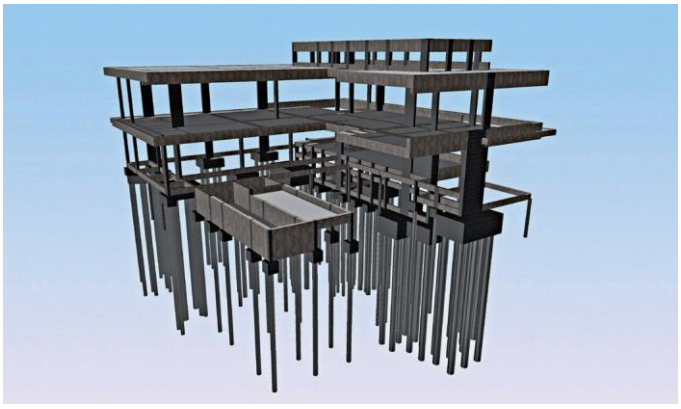


3D Model - Eng Marcel Cassandri Romero Farinha

Best of all, these gains are achievable without the need to model each armature bar in 3D for conventional designs. The detailing of the frame can and should continue to be done in 2D assisively, reserving the three-dimensional modeling of bars only for complex elements or when there is a specific demand for manufacturing. With standardized measurements on formwork elements and planks (e.g., pavement, shaft, section, fck, covering, aggressiveness class, concrete phase, steel type and gauge where applicable), it is possible to extract reliable quantities and feed directly into the budgeting process, integrating with 5D flows without overloading the modeling.

It is not uncommon to find professionals who, after going through poorly managed projects under the banner of BIM, boast of not using it.

For those who use TQS, a pure flow can be extremely effective. TQS remains the source of truth for calculation and detailing, and BIM acts as a coordination and verification layer. The publication of IFC models via interoperability, or RVT via interchangeability, as a reference for compatibility, and the clear communication of relevant interferences are sufficient to reap the benefits, without duplicating efforts.



3D Model - Eng Marcel Cassandri Romero Farinha

For projects that require deeper integration or where the coordination environment occurs predominantly in Revit®, a hybrid TQS–Revit® flow proves to be a robust solution. The key is a disciplined mapping between the TQS analytic model and the physical model in Revit®, ensuring that axes, levels, and nomenclatures are aligned. TQS remains the engine of the design, while Revit® serves as the aggregator of the physical model for coordination and view extraction.

The key is a disciplined mapping between the TQS analytical model and the physical model in Revit®, ensuring that axes, levels, and nomenclatures are aligned.

In short, BIM is not a panacea, nor an enemy. It's a tool. For the structural designer, its value is manifested when the focus is on tangible results: avoiding rework, optimizing quantities, and ensuring that holes and *inserts* are in the right place. Less *hype*, more clarity of scope and pragmatic application are the way for BIM, in fact, to become an ally in the day-to-day of projects, contributing to more efficient engineering and fewer surprises on site. Using views and documents extracted from a multidimensional model is not a frill: it is a precise instrument and, in the face of the growing complexity of undertakings and increasingly short deadlines, an operational necessity that reduces ambiguities, speeds up revisions and connects design, budget and work.

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ENECOL Engenharia Estrutural e Consultoria, Natal, RN

Comparative study between TQS and Etabs®

By Eng. Bruno Teixeira Aschi, Eng. Flávio A. B. May, Eng. César Silva Pinto and team of engineers CSP Projetos e Consultoria

CSP Projetos e Consultoria was founded in 1996 and, since then, has fundamentally developed the activities of consulting and auditing of structural design, currently called ATP – Technical Project Evaluation (also known as CQP and ACP), operating throughout the national territory and with more than 30,000,000 m² of verified and attested structures. Formed by a qualified team of engineers with academic specializations and multidisciplinary professionals in structural engineering, CSP Projetos e Consultoria is committed to professionalism, ethics and competence.

Our way of working is timeless since for 30 years our mission has always been to verify various structural systems with the premises related to the consequence class CC3 defined in the last revision of ABNT NBR 6118:2026, item 5.3, evidence of the quality of our work.

1. Objective

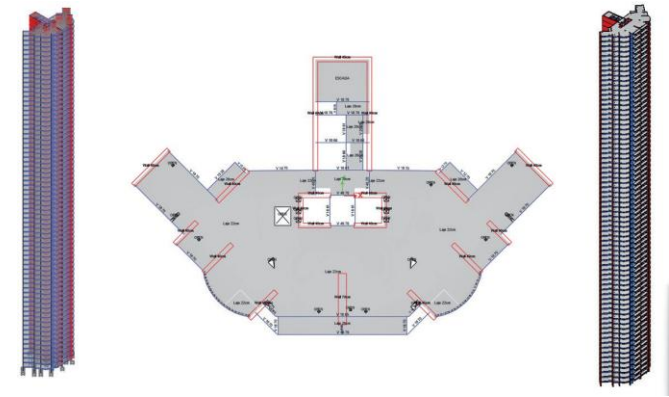
The present study aims to perform a comparative analysis between **TQS** software, widely used in Brazil for reinforced concrete building projects, and **Etabs**®, developed by Computers and Structures Inc. (CSI) and consolidated internationally as a reference for modeling and analysis of multi-story buildings.

The comparison is based on the **FIN TOWER** structural model (figure 1), provided by TQS Informática, adopted as a case study for this evaluation.

In this study, the focus is on **global results**, covering:

- Loads transmitted to foundations;
- Horizontal displacements due to wind;
- Structure vibration modes.

Figure 1: Building structure used in the comparison



Etabs® Model Etabs® Formwork TQS Model

2. Input Data and Assumptions

2.1. Geometry and structural elements

In the TQS structural model, wall columns and slabs are represented by bar meshes in two orthogonal directions, with spacing parameterized by criteria. Beams are modeled as member elements.

In Etabs®, the following model was adopted:

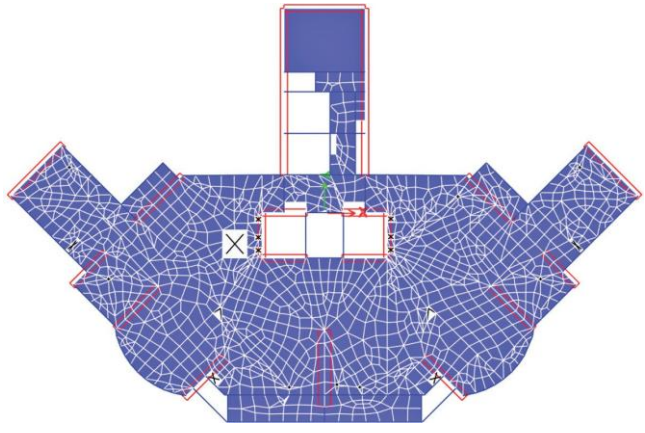
- **Shear wall** by **shell elements**(*walls*);
- **Beams** as Bar Elements **(***frames*);
- **Slabs** as a plate element (*shells*), using the program's automatic discretization, which preferentially generates quadrilateral and, when necessary, triangular meshes, to be compatible with adjacent structural elements.

In TQS, the slab referring to the projection of the staircase was defined without discretization in a grid, acting only as a loading element. To maintain equivalence, in Etabs® this slab was modeled as a membrane with reduced stiffness modifiers, so as not to influence the overall behavior.

The other slabs were considered *shell-thin in* the ETABS®, as well as the wall columns, which in turn were modeled as *walls*, omitting the shear deformability to make it compatible with the option adopted in the TQS of not considering the shear deformation.

Therefore, the Etabs® slabs were discretized as shown in the following image.

Figure 2: Automatically generated mesh in Etabs® for the slabs



For the shear walls in Etabs®, automatic discretization was used in rectangular elements with maximum dimensions of 50 cm, in addition to the automatic creation of support constraints at the foundation level.

In the consideration of the external links of the TQS, nodal springs are determined in the foundations, and standard values can be adopted. In Etabs®, it is also possible to adopt such criteria, but there are a range of ways to perform this application with springs. To eliminate the possibility of differences in the results resulting from the application of springs, in this analysis, it was decided to consider in both software perfect crimping at the bases of the columns.

2.2. Properties of concrete

The material properties were defined in accordance with the criteria of the model provided by TQS Informática, and the same parameters were adopted in the Etabs®.

- Characteristic compressive strength of concrete (fck): 50 MPa
- Modulus of Elasticity of Concrete (Ecs): 36.630 MPa
- Specific weight of concrete: 2,5 tf/m³
- Poisson coefficient of concrete (ν): 0,20

2.3. Loads

The loads adopted in the development of the Etabs® model were defined in such a way as to fully respect those present in the model provided by TQS, ensuring consistency in the comparative analysis. In this sense, linear loads were considered for the masonry, as well as in the TQS model, in addition to the loads distributed by area in the slabs, which in Etabs® were launched by means of the *Uniform load sets tool.*

In the case of masonry on beams, the loads were applied directly as linear loads. For the masonry supported on slabs, bars with the *null frame* property were created, which do not contribute to the structural rigidity or to the calculation process, but allow the correct distribution of the loads and serve as a geometric reference for the automatic discretization of the slabs.

For the wind loads, nodes were created on all floors, positioned exactly according to the reference axis indicated in the TQS wind viewer. The values of the wind actions were also extracted directly from this viewer, to eliminate divergences between the programs.

As for accidental loads, TQS applies this load only in slab regions, not invading beams and columns, which is consistent with the construction reality. In Etabs®, the loads include the regions of beams and columns, generating a small surplus. For the permanent loads distributed by area, a similar behavior is observed, but the difference is also influenced by the additional consideration of the linear masonry loads. In Etabs®, a common practice is to extend null *frame members* to the axis of nearby structural elements, ensuring better discretization and avoiding the formation of nodes that are too close together. This practice, however, generates an inaccuracy, that is, a small increase in the loads of the masonry in Etabs® compared to TQS.

2.4. Other modeling criteria

2.4.1. *Models with increased stiffness*

The modeling was divided into two groups, analogous to the TQS procedure by means of the ELU and ELS gantries intended for last and in-service verifications, respectively. The loads on the foundations from the gravitational and wind actions were extracted from the models that simulate the TQS ELU frame, while the analysis of horizontal and vertical strains, as well as the modal analysis, followed criteria equivalent to the ELS frame.

The calculation methodology applied in TQS simplifies the analysis of the construction process of the building's floors by increasing the axial stiffness of the columns, a recurrent practice in Brazil and in other regions of the world. In addition, there is an option to increase the transition beams, both to simulate any construction effects, but mainly to ensure more safety in the design of these beams. In this context, the program usually presents two scenarios: the stiffened case, with a tenfold increase in the axial stiffness of all columns and in the flexural rigidity of transition beams; and the case called VTN, in which the beams do not receive an increase in stiffness, but the columns have their axial stiffness multiplied by three, a value adopted as standard. Considering that there are no transition beams in this structure and aiming at the consistency of the comparison between the *software*, it was decided to disable this option in TQS, maintaining only the threefold increase in the axial stiffness of the columns.

To reproduce this methodology in Etabs®, it was necessary to develop separate models, like the separation into frames used by TQS. The increase in the axial stiffness of the *wall elements* representing the columns was applied in the f22 direction. It is recognized that this consideration in bidirectional elements also leads to an increase in the flexional stiffness of the shell elements, but, due to the limitation of the modeling process, this criterion was maintained. This adaptation was used only in comparisons referring to gravitational loads, in which the effects of the construction process are relevant.

In all comparisons, elements with rough stiffness were considered, without plasticization in the Etabs®. However, for the comparisons with the results extracted from the TQS ELU frame, such as the loads on the foundations, stiffness reduction factors were applied for approximate consideration of the NLF, with values of 0.8 for columns, 0.4 for beams and 0.3 for slabs.

In the analysis related to wind actions, the columns were modeled with gross axial stiffness, since the construction process does not interfere in the results of these analyses, but taking into account the NLF as well as the TQS.

For slabs and beams, the stiffness values were adjusted according to the NLF defined in the TQS.

In the comparisons referring to the ELS frame, the gross stiffness was adopted for beams and slabs, without additional modifiers. For gravitational load deformations, the columns received a threefold increase in axial stiffness, while beams and slabs remained with gross stiffness.

In the displacements resulting from wind actions and in the modal analysis, all elements were maintained with gross stiffness, including the columns.

To define the modal mass, *100*% of the self-weight and the permanent loads were adopted in both software, in addition to 30% of the overload.

Table 1: Summary of Modeling Criteria in Etabs® for Each Analysis Type

Type of analysis Comparative	Columns (walls)	Beams	Slabs
Gravitational Loads (Foundation – ULS)	Axial stiffness multiplied by 3 (f22) x NLF = 0,8 = 2,4	NLF = 0,4	NLF = 0,3
Wind loads (foundation – ULS)	Axial Stiffness = 1 (Gross) x NLF = 0,8 = 0,8	NLF = 0,4	NLF = 0,3
Deformations by gravitational loads (SLS)	Rigidez axial multiplicada por 3 (f22)	Gross	Gross
Wind deformations (SLS)	Gross	Gross	Gross
Modal analysis (SLS)	Gross	Gross	Gross

3. Results

The presentation of the results will be made by simultaneously comparing the Etabs® model with the TQS models of steps A and B, to understand the effects that approach and distance as the TQS criteria are changed. In stage A, standard TQS criteria were changed in such a way as to consider the most elastic model; For example, the integral torsion stiffness in the beams and slabs was considered and some plasticization criteria were deactivated. In step B, the standard TQS criteria were considered, which are configured for a modeling more compatible with the response.

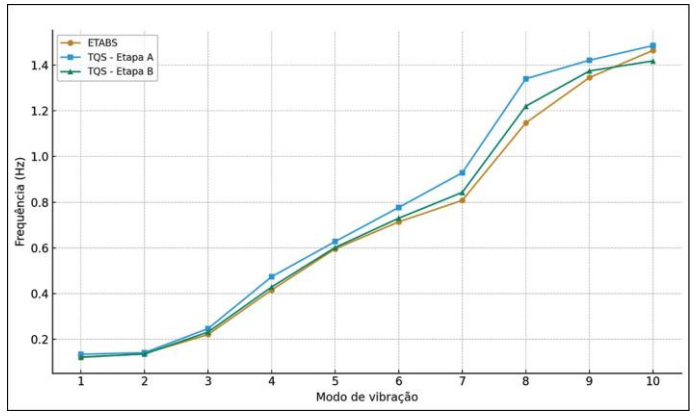
3.1. Results of stages A e B

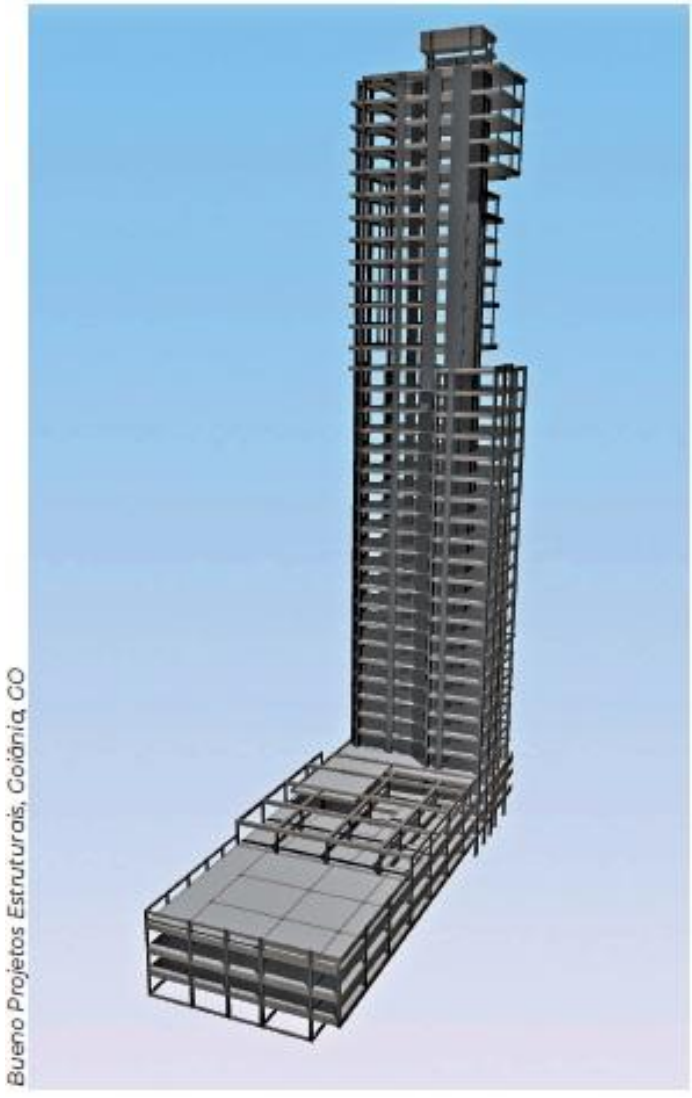
3.1.1. Comparison of vibration modes an natural frequencies

The first three vibration modes are identical on all models, with the 1st mode being inflectional in the X direction, the 2nd mode being inflectional in the Y direction and the 3rd mode, torsional.

The modal frequencies obtained were very close (Figure 3). It is observed that there is greater convergence between the results of the TQS in stage B and the Etabs®. The biggest difference between the two programs occurred in the 8th mode, reaching 6.4%, while in the first three modes, which are usually the preponderant ones in the dynamic response, the differences did not exceed 4.8%. It is possible to note that the frequencies obtained in Etabs® are slightly lower than those of TQS, which can be justified by the higher mass considered in Etabs® due to the imprecision of the permanent and accidental loads described in item 2.3.

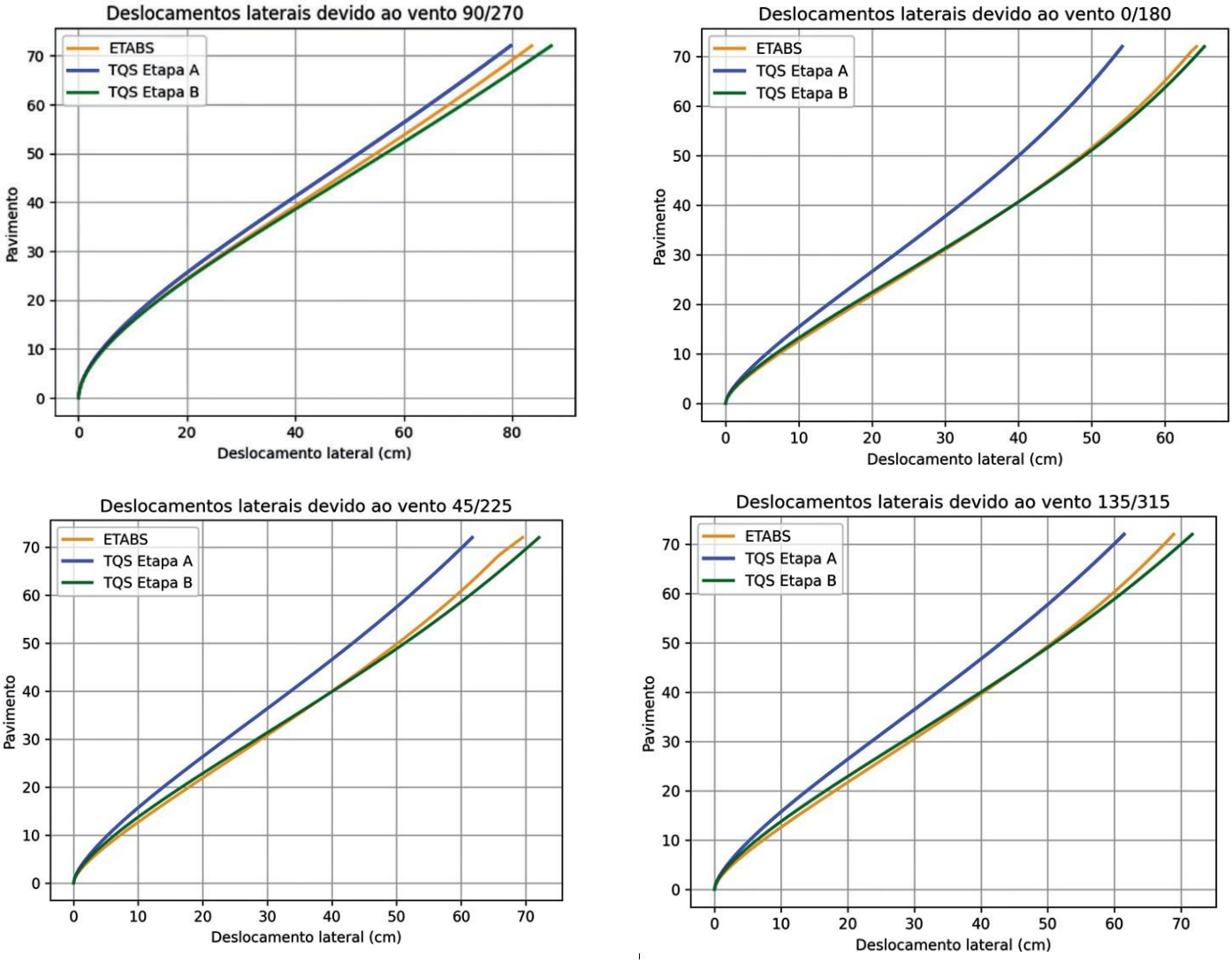
Figure 3: Natural Frequency Comparison – 10 First Modes

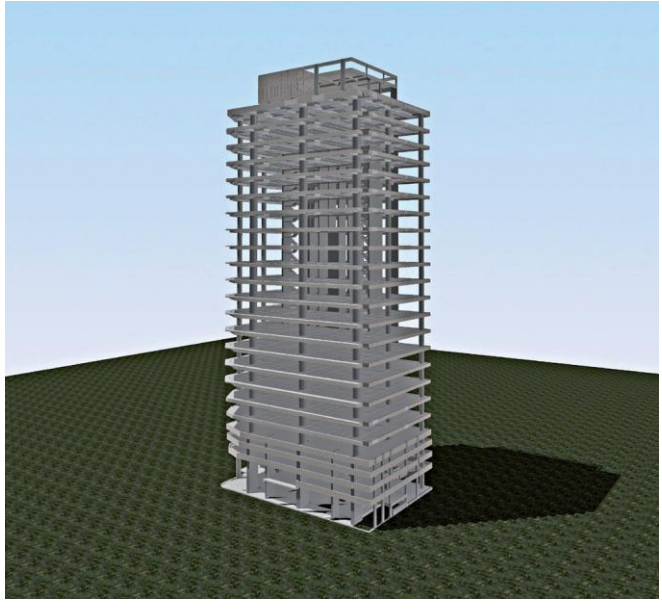




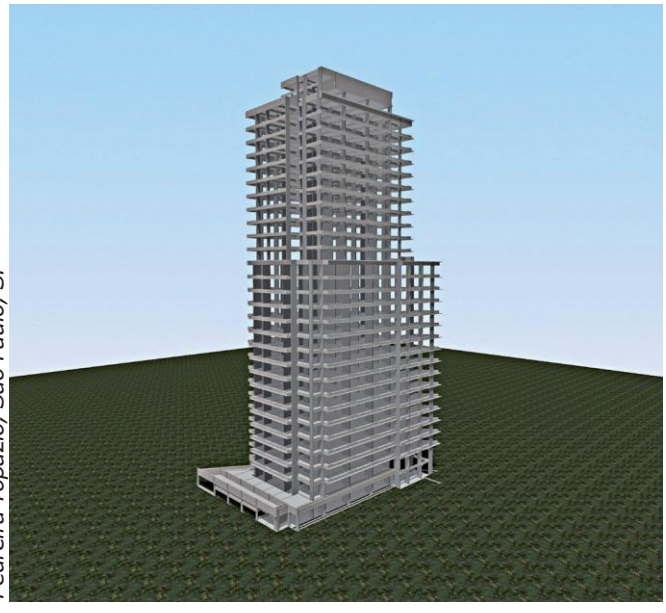
3.1.2. *Comparison of lateral displacements due to wind*

Figure 4: Lateral displacements at the top of the building due to wind





Sigma1 Consultoria e Projetos, Rio de Janeiro, RJ



Pedreira Topázio, São Paulo, SP

The analysis of the results shows that the three models show very similar behavior, with small differences along the height of the structure. It is noted that, in global terms, the displacements obtained in **TQS stage B** are closer to those of Etabs®, while the model of **stage A** presents lower results.

This difference is directly related to the plasticization and flexibility criteria adopted by TQS in Stage B, which make the model more compatible with the Etabs® modeling.

In general, the lateral displacements remain in very close range, showing good convergence between the *software* for the criteria defined by default in the TQS.

3.1.3. *Comparison of gravitational loads os foundations*

The forces on the foundations of each column were surveyed for the total gravitational load (self-weight + permanent loads + accidental loads). The following graphs present the results obtained in Etabs® and TQS (steps A and B), all following the convention of global axes compatible with the TQS criteria.

Figure 5: Comparison of Fz forces between Etabs® and TQS A and B per column for gravitational loads

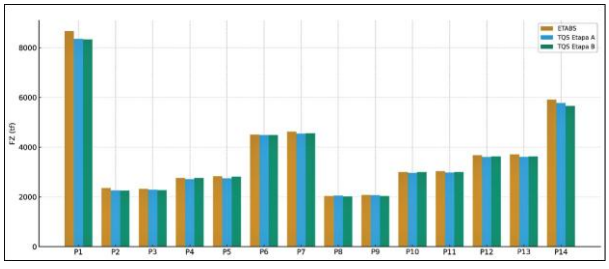


Figure 6: Comparison of Mx forces between Etabs® and TQS A and B per column for gravitational loads

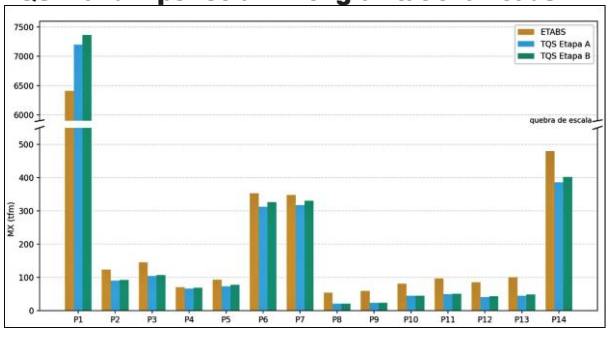
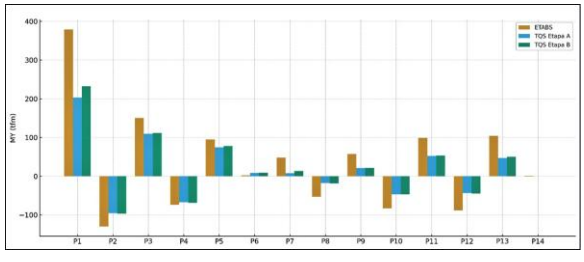


Figure 7: Comparison of My Forces between Etabs® and TQS A and B per column for Gravitational Loads



The analysis of the gravitational loads on the foundations shows that, for the vertical force **FZ,** the differences between TQS and Etabs® remain small, not exceeding about 5%. This behavior demonstrates good convergence between software, ensuring consistency in the overall results for vertical loading. Again, it is worth remembering that, as described in item 2.3, there reflects the inaccuracy of variable permanent loads in the Etabs® model.

In relation to the bending moments MX and MY, the percentage variations were more relevant. In the case of MX, deviations reach ranges between 10% and 40% in some columns, while for MY, even more pronounced differences were identified, reaching values above 40% in specific columns. These results demonstrate that the modeling between the programs presents greater sensitivity in the reproduction of bending moments, requiring additional attention in foundation analysis and soil-structure interaction.

3.1.4. *Comparison of wind loads on foundations*

The forces on the foundations of each column were raised for all the wind directions considered. Since the pairs 0/180°, 90/270°, 45/225° and 135/315° have the same magnitude with opposite limits, it was decided to present only the results of the smallest angle of each pair, maintaining the convention of global axes compatible with the TQS criteria. The following figures bring together the results of Etabs® and TQS (steps A and B), allowing direct comparison by column and by force component.

Figure 8: Comparison of forces Fz between Etabs® and TQS A and B per column for wind 0°

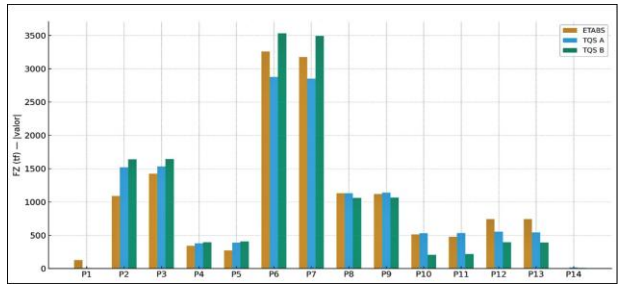


Figure 9: Comparison of Mx forces between Etabs® and TQS A and B per column for wind 0°

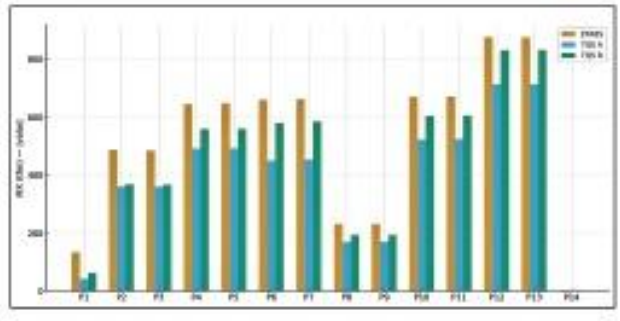


Figure 10: Comparison of My efforts between Etabs® and TQS A and B per column for wind 0º

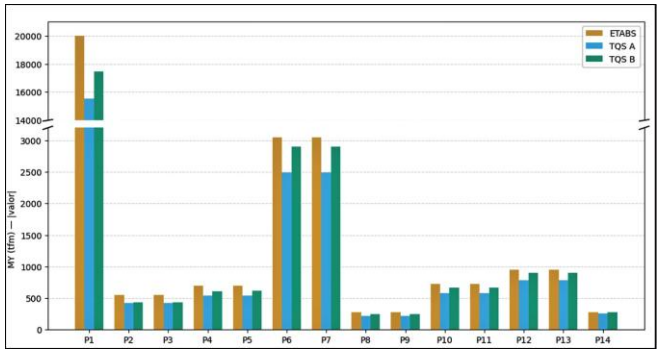


Figure 11: Comparison of forces Fz between Etabs® and TQS A and B per column for wind 45º

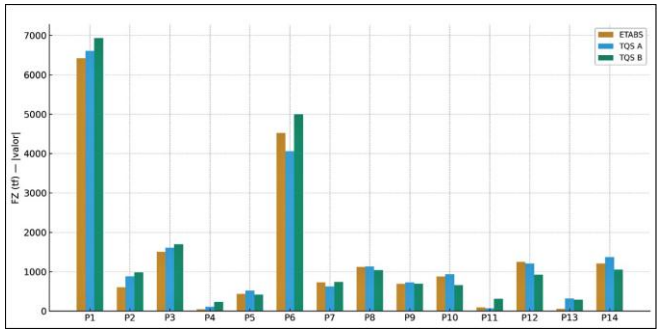


Figure 12: Comparison of Mx forces between Etabs® and TQS A and B per column for wind 45º

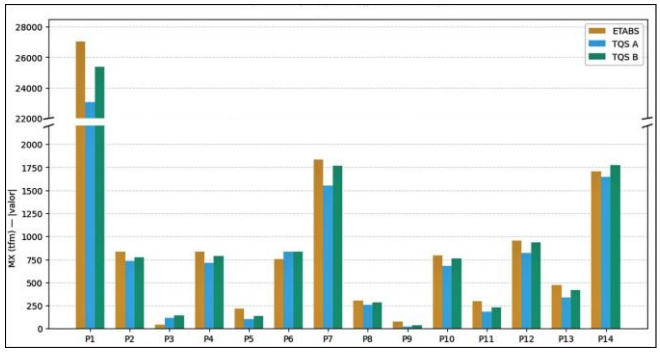


Figure 13: Comparison of My efforts between Etabs® and TQS A and B per Column for 45º wind

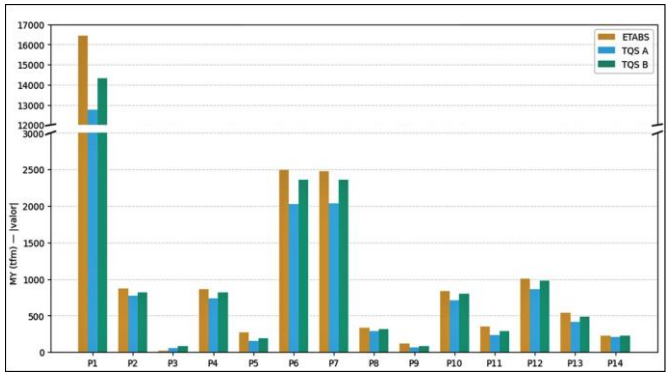


Figure 14: Comparison of forces Fz between Etabs® and TQS A and B per column for wind 90º

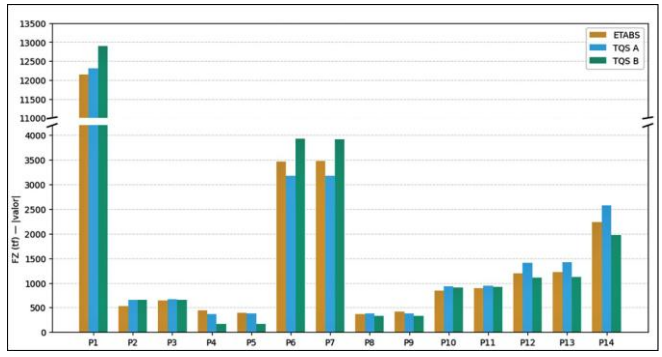


Figure 15: Comparison of Mx forces between Etabs® and TQS A and B per column for wind 90º

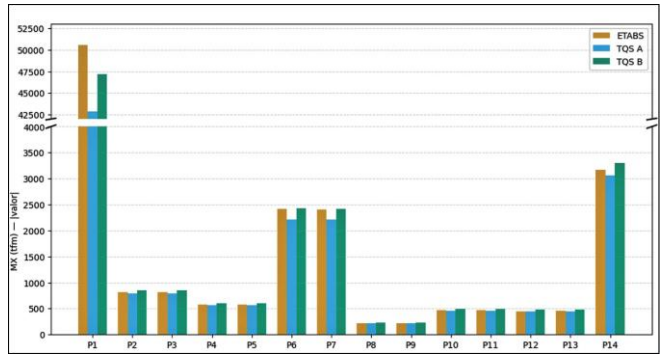


Figure 16: Comparison of My forces between Etabs® and TQS A and B per column for wind 90º

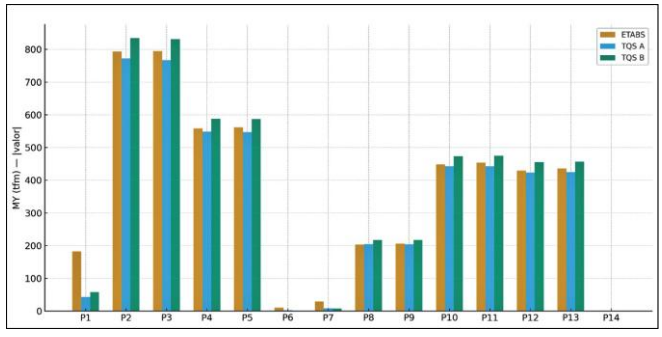


Figure 17: Comparison of forces Fz between Etabs® and TQS A and B per column for 135º wind

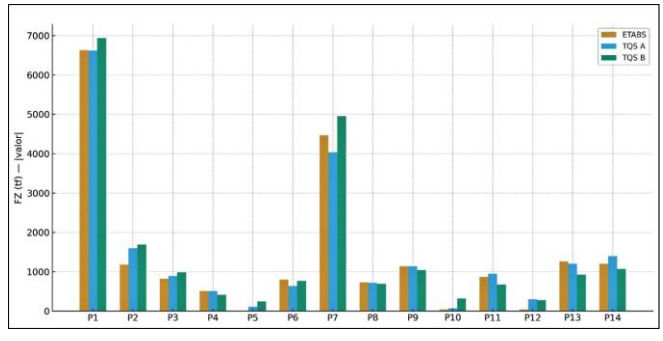


Figure 18: Comparison of Mx forces between Etabs® and TQS A and B per column for wind 135º

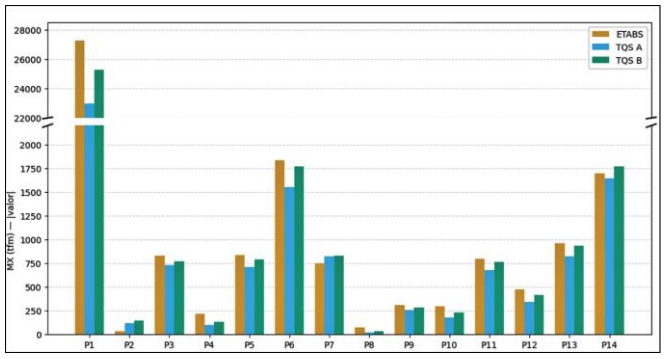
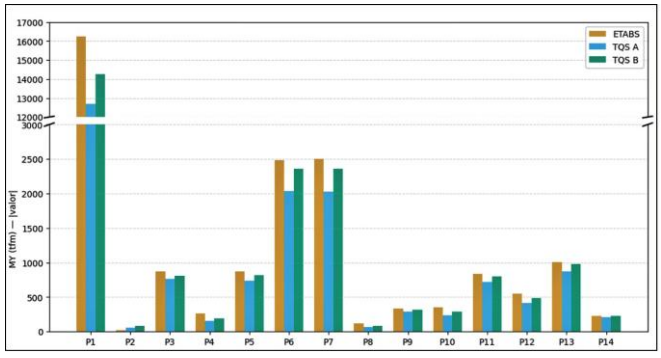


Figure 19: Comparison of My forces between Etabs® and TQS A and B per column for wind 135º



In general, good consistency is observed among the models regarding the distribution pattern of the forces generated by the wind. In terms of order of magnitude, **TQS – step B** tends to be closer to **Etabs®** along the different directions, reflecting the influence of the standard flexibilization/rigidity criteria adopted in this configuration. On the other hand, **TQS – stage A** shows slightly more pronounced differences in some columns, especially in the current components, which is in line with the assumptions of greater rigidity in this stage.

In summary, the comparisons indicate **satisfactory global convergence** between Etabs® and TQS for wind loads on the foundations, with greater adherence to the results of the **TQS – stage B**, in which the values of standard criteria were adopted.

4. Conclusion

The comparative analysis between Etabs® and TQS for the FIN TOWER model showed that the overall results of the two software programs show good convergence, especially regarding:

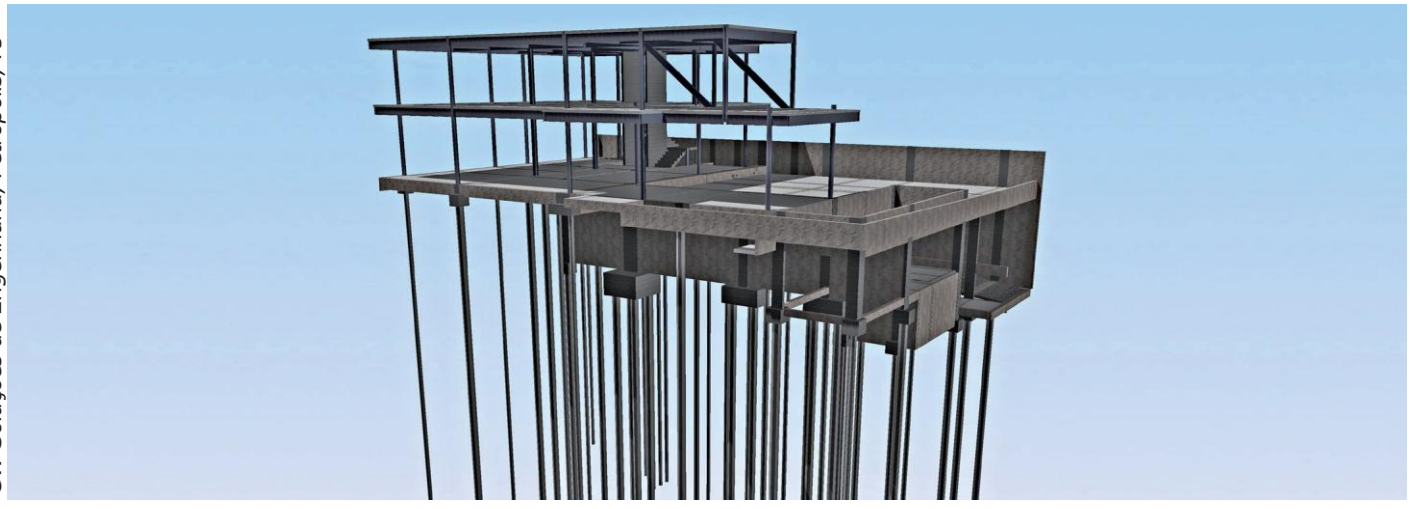
- Gravitational loads on the foundations: differences of less than 5% in the principal vertical forces (Fz), demonstrating consistency in the evaluation of the axial actions transmitted to the columns.
- Lateral displacements due to wind: satisfactory compatibility, with greater proximity between Etabs® and TQS in stage B.
- Natural frequencies and vibration modes: low percentage differences (up to ~6%), preserving the overall characterization of the dynamic behavior of the tower.

The most relevant discrepancies occurred in the bending moments (Mx and My) in the foundations, which presented the highest percentage dispersion. These points reinforce the influence of the internal criteria for plasticization and flexibility of the slabs in the TQS.

In summary, the study confirms that for the building analyzed, TQS, in its standard configurations, produced global results compatible with those obtained in Etabs®, an international reference software. The observed proximity supports the reliability of TQS for global modelling of tall reinforced concrete buildings.

Local analyses of stresses on structural elements have not yet been evaluated in this study.

Etabs® is a trademark and service mark of Computers and Structures, Inc. (CSI), registered in the U.S. and other countries.



GW Soluções de Engenharia, Petrópolis, RJ

New features for the design of prestressed slabs and beams in V26

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RLF - Engenharia de Estruturas
E-mail: reginaldo@rlf.com.br

The V26 version of TQS brought new features in the prestressing modules (slabs and beams) that further assist in the definition of cables and analysis of the results. Many of them were entered into the program based on user requests. In this text, I highlight these new features.

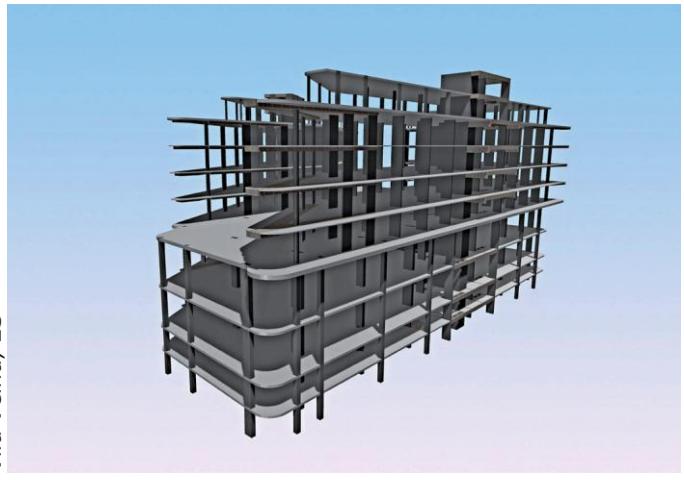
1. Analysis of displacements: Lajepro

Once the prestressing has been defined on a floor, it is possible to carry out a local (model 4: calculation of the hyper-grid) or global (model 6: calculation of the hyper-frame) processing. After this step, the analysis of the displacements in the floor, with the relief forces (Fo-rali) included, must be done through the Lajepro combinations that are shown in the grid or gantry visualizers.

Figure 1. Combinations Lajepro

Until the V25 version, these combinations were affected by the Slide multiplier. *Z* and this often-generated confusion in the analysis, as *the differ and slow* combinations have specific multipliers.

Figure 2. Multipliers



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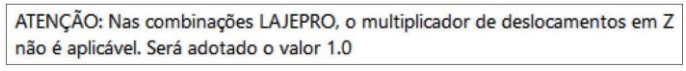
In V26 the multiplier is no longer applied in Lajepro combinations, and the program warns when one of them is selected.

Figure 3. Notice on "desl. Z = 1.0"

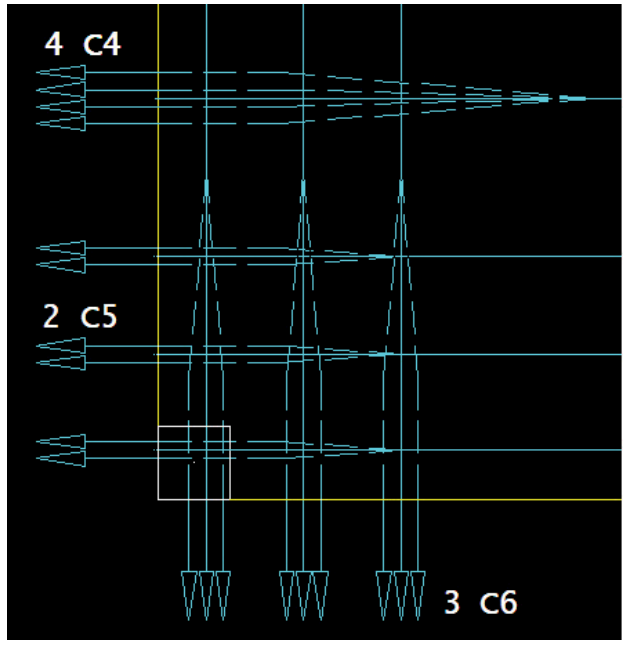


2. New DWGs for anchor design

New drawing blocks, specific to non-adherent proten-sion, have been created to represent the active anchoring side ($annat. DWG) and passive ($annpa. DWG).

In this way, the designer will be able to visualize the separation of the beams formed by 2, 3 or 4 strands and better analyze possible interferences.

Figure 4. New drawing blocks for the anchors



If the user still wants to generate drawings with the *old DWGs* (quantities of strands indicated by dashes and without deviations), just edit the block prefix in the *Prestressed Slab Drawing Criteria*, including a letter *a* at the end ($an-cream and $annpaa).

Figure 5. Old-fashioned active anchor blocks

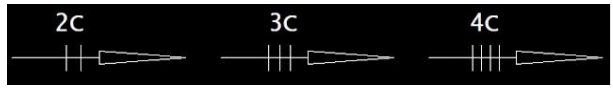
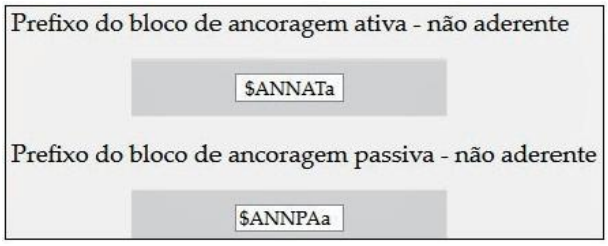
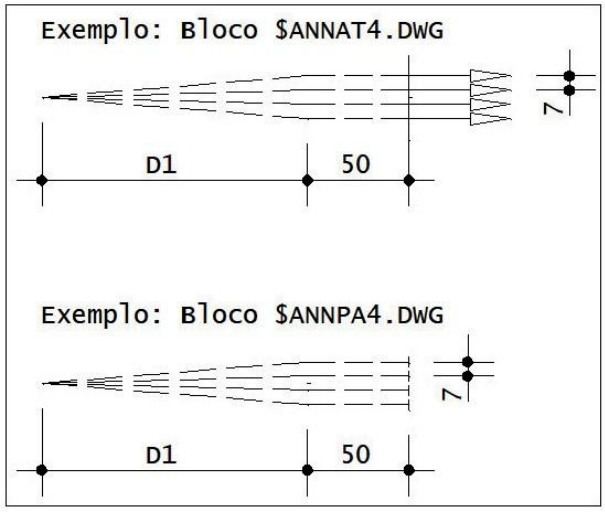


Figure 6. Anchor Design Criteria



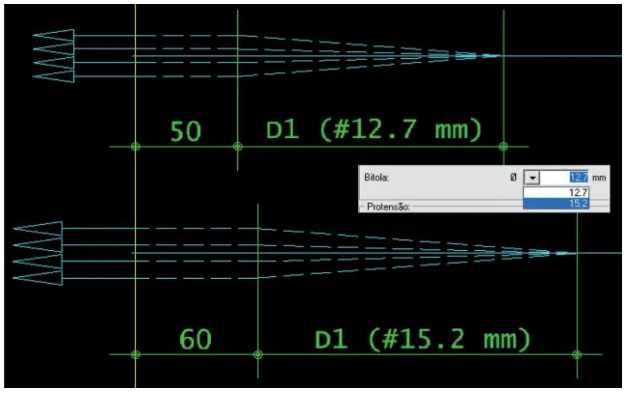
The new blocks that represent bundles with 2 to 4 strands were designed (on a 1:1 scale in meters) with measurements that, after the generation of the cables in plan or 3D, ensure a minimum spacing of 7 cm between the anchor plates, a deviation section of 1/12 in the plane of the slab and a minimum straight end (according to ABNT NBR 6118:2023) of 50 cm.

Figure 7. Detail of the blocks with 4 strands



The measurements of these blocks are automatically adjusted according to the gauge chosen in the UPR data. The total length of the continuous cable being calculated with the parameters defined in the prestressed slab criteria (*Detailing >> anchoring*).

Figure 8. Block measurements according to strand

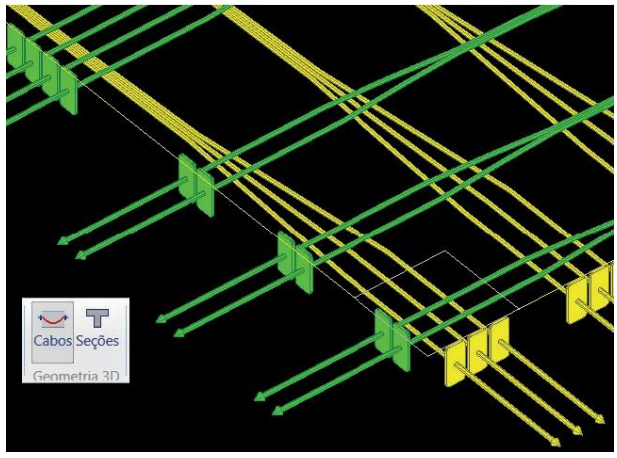


To edit a block, simply access the *Tools >> Utilities menu >> the Graphic Editor (EAG)* and select an anchor *DWG* in the *folder C:\TQSW\SUPPORT\SLABS\BLOCKS*.

3. 3D Visualization of tendons/cables

Within the prestressed slab editor, a button menu called *3D Geometry* has been inserted. Through the *Cables* option, the designer gets a 3D view that shows all the beams and anchor plates. On the active side, each strand is drawn with a length beyond the plate/shape.

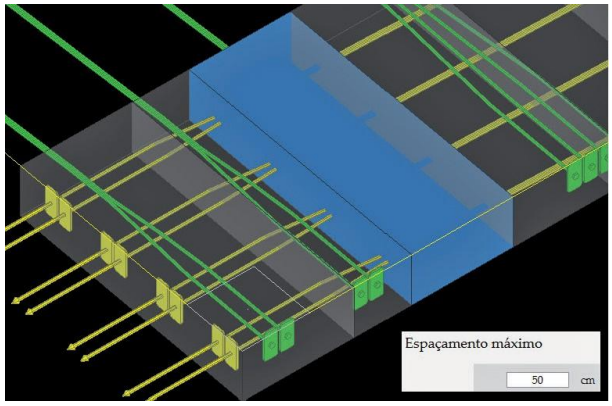
Figure 9. Example of beams at the ends of the slab



ALKIE Engenharia, São José dos Pinhais, PR

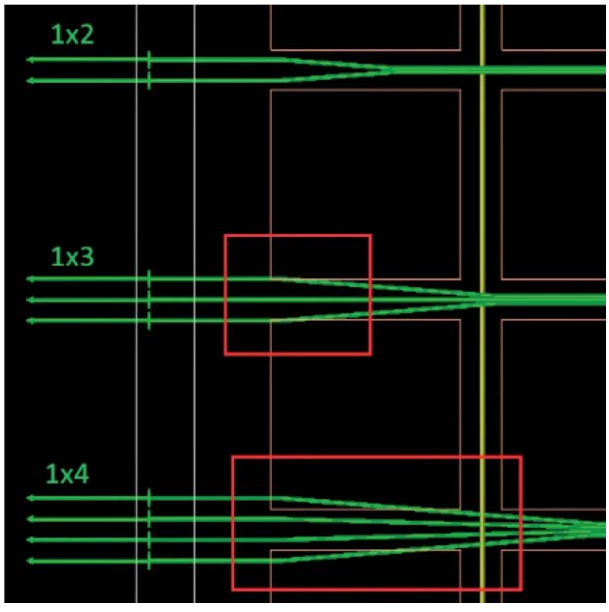
The *Sections* option highlights the excerpts of an RPU/RTE that are used for the extraction of efforts and analyses. Remember that the maximum spacing between sections is set in the criteria file.

Figure 10. Detailing the sections of an RPU



In the ribbed slabs, the new anchor blocks help to visualize the possible interferences between the strands and the buckets in the opening section of the bundle.

Figure 11. Beaming in the ribbed regions



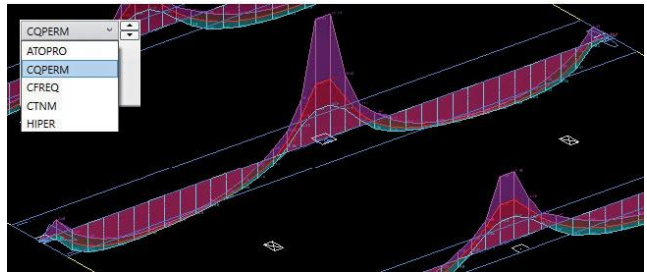
4. 3D Diagrams

The 3D Diagrams *menu has also been created*, which allows the user to analyze the force diagrams acting on all sections (minimum, average, maximum moment, cable moment, force on the cable at the time of prestressing and infinite time) without having to enter the *elevation/profile view mode*.

Figure 12: Commands for controlling 3D diagrams

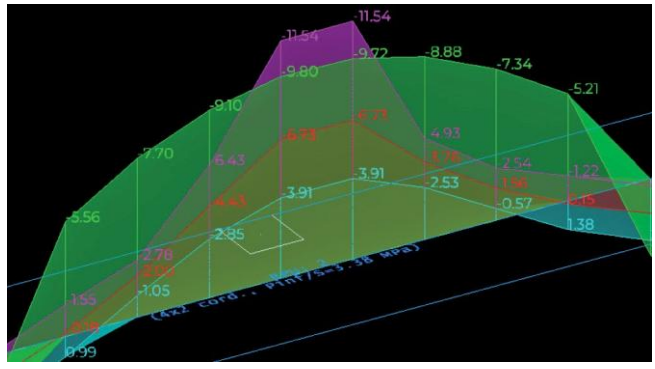
Diagrams are shown for all RPUs/RTEs from one direction (horizontal or vertical), conform to the selected combination, keeping the same colors that are adopted in *the Strains/Cable Profile window*.

Figure 13. Diagrams of bending moments in RPUs



Scale bars *adjust* the display of the chosen day-grams and the height of the texts.

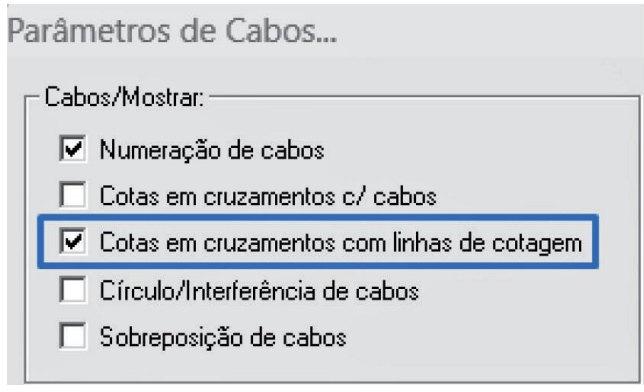
Figure 14. Moment wrap visualization



5. Auxiliary Dimension Lines

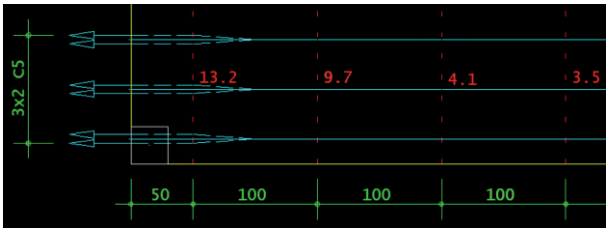
A command *has been included in the* cable parameters menu that allows you to show the elevations of the cables
(Y) only at the points of intersection with the additional dimension lines.

Figure 15. Cable Parameters



Until the V25 version, these values were presented together with the elevations at the cable crossing/interference points. With this feature, there is no need to turn off level *11* (Quota of cables in plan) when saving the final drawing.

Figure 16. Cable Elevations on Dimension Lines



6. Diagrams with cracking moment

A feature has been added to the *Diagram Parameters* menu that allows you to highlight, also within the prestressed slab editor, the sections in the bending moment diagrams that have values (Ms+ and Ms-) lower than the cracking moment (Mr). Until now, this feature was only available in the *Slab Reinforcement and Effort Editor*.

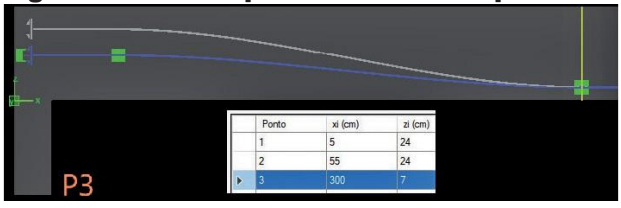
The colors of the diagrams used to highlight these moment snippets (Ms ≤ Mr) can be set by the user through the Edit >> *Levels menu* >> *Al-terar*. The following levels are reserved: 213 = *Mr+* e *214* = *Mr-*.

Figure 17. Diagrams with the inclusion of "Mr"

7. VPRO: 3D points on the cable profile

3D objects were created that mark the points (xi, zi) defined by the designer throughout the cable profile, facilitating the identification of each point for eventual adjustments.

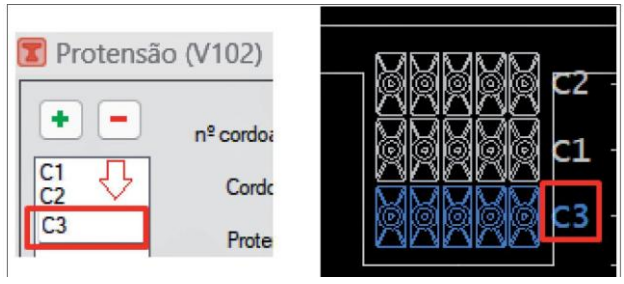
Figure 18. Control points in the cable profile



8. VPRO: rename cables

After adding all the cables, the name that identifies a profile can be edited. Just double-click on the desired field. This allows for better organization of the final drawings (stroke and cross-section).

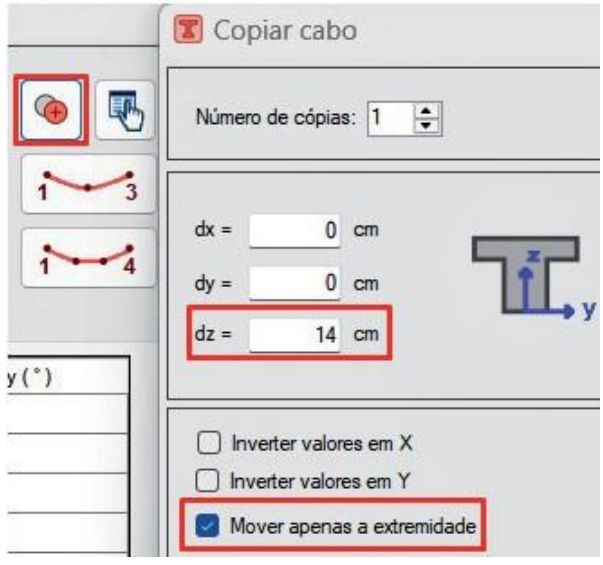
Figure 19. Possibility to rename the cables



9. VPRO: cable copy

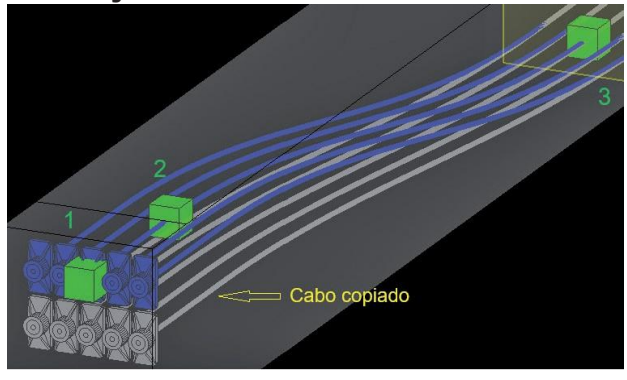
With the new *Copy Cable* command, you can duplicate a profile *n* times by adding an offset value.

Figure 20



In the case of vertical copies (+/- dz) you can choose to move only the points located at the ends of the profile (section of the anchors). The other points will be kept at the same elevation as the copied cable.

Figure 21. Example of copying cables only vertically



10. VPRO: cracking (SLS)

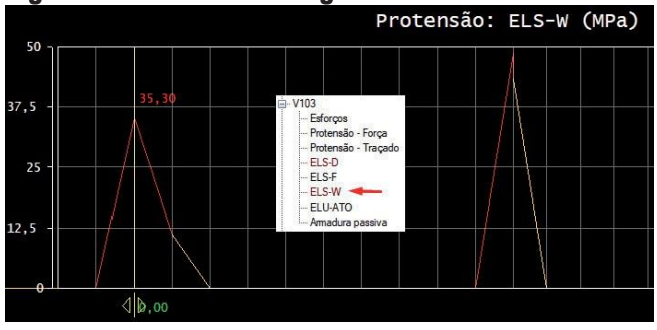
The verification of the *service limit state - crack opening was included*, thus allowing the analysis of prestressed beams with partial prestressing (*wk* ≤ 0.2 mm in the frequent combination). Remember that the other requirements indicated in chapter 13.4.2 of ABNT NBR 6118:2023 must also be met.

Figure 22. Excerpt from table 13.4 of ABNT NBR 6118:2023

Tipo de concreto estrutural	Tipo de protensão	Classe de agressividade ambiental (CAA)
Concreto protendido nível 1 (protensão parcial)	Pré-tração	CAA I
	Pós-tração	CAA I e CAA II

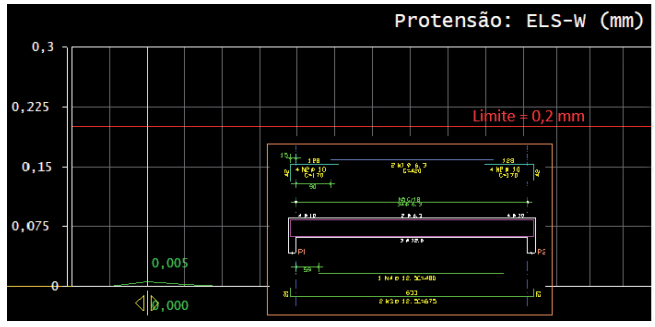
After the prestressing on the beams and overall processing has been defined, if the passive reinforcements have not yet been detailed, VPRO initializes the SLS graph indicating only the stress on the steel.

Figura 23. Crack Checking - Stress in Steel



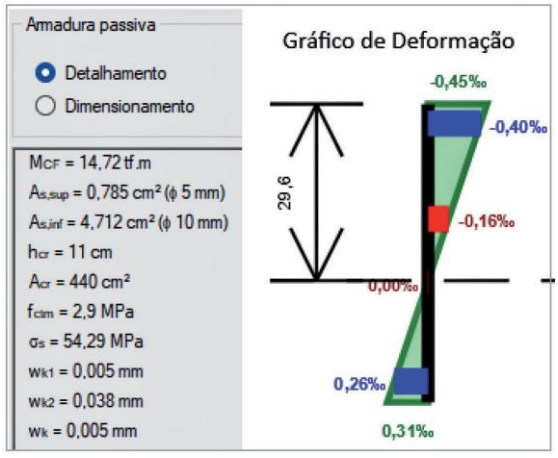
After executing the *TQS-Beams command* >> *Dimension, Detail and Draw,* you must return to VPRO for the program to update the ELS-W graphic again. Thus, the crack opening values (*wk*) in each cross-section will be shown, already considering the reinforcement defined by the user.

Figure 24. Crack Opening with Detailed Armor



More information on crack opening can be obtained by double-clicking on a section.

Figure 25. Verification after final detailing

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