THE MANIFESTO

FOR SUSTAINABLE AND SECURE CONSTRUCTION

Understanding the challenges of Mechanical Splices compared to traditional overlapping techniques

by LINXION The Original of BARTEC, creator of technical solutions since 1988

EDITO

Philippe HUET
CEO of LINXION The Original of BARTEC

*In light of the planet's ecological **challenges** and the need for innovation in reinforced concrete construction, it is essential to introduce **new rules** and guidelines **that align with** the world of today and tomorrow.*

Rebar is the **skeleton** of these reinforced concrete structures. It can be compared to the human body's skeleton, and the mechanical splices are its joints. The strength of the structure will depend on the **strength** of the rebar and its mechanical splices.

Advancements in **construction techniques** and raw materials have allowed us to build ever larger, taller, stronger, and more breathtaking buildings. It is the work of human ingenuity in all its splendor that enables us to be builders, dare I say it... of the impossible. Today, more than yesterday but less than tomorrow.

However, we must increasingly consider the **risks**. These are numerous: earthquakes, accidents, attacks, and natural wear and tear. These risks can sometimes have minor consequences but, in other cases, lead to disasters: **cracking** of the concrete that causes rebar corrosion, **load failure** that may result in collapse.

We must also consider **the impact** on the planet: the consumption of raw materials, the pollution caused by production and transportation to construction sites, and, of course, the carbon footprint generated.

We, **LINXION The Original of BARTEC**, the creator and original inventor of the BARTEC rebar splice and experts in our field, have been working for many years to ensure that **our products are aligned with sustainable development, quality, safety, and reliability.**

« SUCCESS OFTEN TOLERATES CHANCE BUT RARELY IMPROVISATION »

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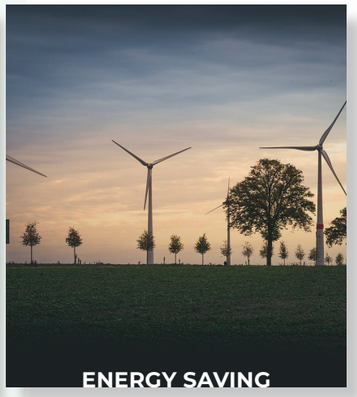
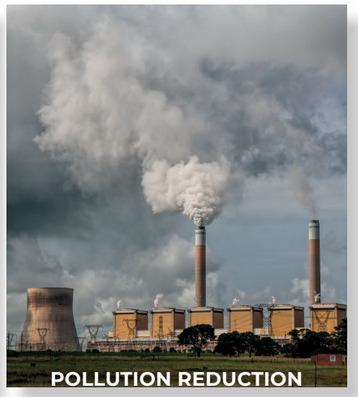
OUR REASONS FOR ACTION

For the past ten years, we've been striving to improve the construction sector based on these 3 pillars :


SUSTAINABLE CONSTRUCTION


ENERGY SAVING


POLLUTION REDUCTION

Today, steel production generates around **8% of the world's CO2 emissions**. For the sector to meet the 2050 zero-emissions target, emissions must fall by at least 30% by 2030. This can only be achieved in **two ways** :

- By **reducing** emissions linked to steel production.
- Using **less steel** wherever possible.

Building is more than just assembling materials,

also means calculating the impact that the building will have on its territory, and preventing any negative consequences.

Materials are not just considered as they are, but seen as a whole, with their history, provenance (CO2 emissions), and manufacturing (air, water and soil pollution, workplace safety, waste disposal).

We now need to understand **which products are sustainable** and which are not. Many materials are now banned (asbestos, lead, CFCs...), and others will follow... to **preserve the environment** and ensure a very low impact on the population.

A CONCRETE VISION

STARS S T A R S

Splicing Technology Allows Reduction of Steel

We limit our impact on the environment with our STARS approach, **considerably reducing** the use of steel.

STARS is an approach that means « **S**plicing **T**echnology **A**llows **R**eduction of **S**teel »
(*steel reduction thanks to threaded reinforcing bars with couplers*)

It was born of the need to **reduce** greenhouse gas emissions: one of our main concerns, and **an environmental challenge for the 21st century**.

Thanks to this vision, we offer a different solution to traditional cladding, with reinforcement connections that immediately reduce the amount of steel within the concrete structure.

OVERLAPPING

Two reinforcing bars are placed so as to overlap over a certain length. The length of this overlap, known as the overlap length, is calculated according to the structural requirements and the properties of the concrete and steel.

MECHANICAL SPLICES

Mechanical splices use devices such as sleeves, threaded fittings, clamps or crimping systems to connect the bars.

TODAY, **MECHANICAL SPLICES** ARE NOT AN ALTERNATIVE TO OVERLAPPING.
THEY OFFER MAJOR ADVANTAGES IN THREE DIFFERENT WAYS:

CONSTRUCTION

- Safe solutions. Loads do not depend on surrounding concrete (continuous reinforcement)
- It's a well-known and certified technology
- Prevents rebar congestion
- Design flexibility (smaller sections)
- Saves formwork and operating time

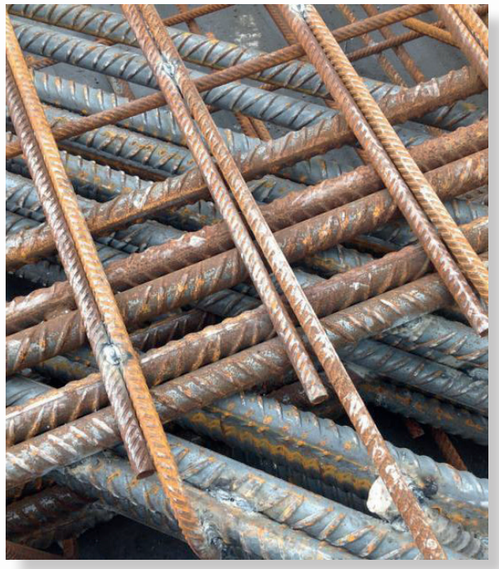
TECHNICAL

- Prefabrication of reinforcement cages
- Use of climbing formwork
- Molded walls and downstand structures
- Fewer splices in longer elements
- Precast concrete elements
- Safety: no protruding bars or reinforcements

ECOLOGY

- Reducing emissions from steel reduction
- Reduce transport emissions (fewer trucks on the road)

A CERTIFIED PROCESS



Numerous certifications exist throughout the world for **testing and securing mechanical splices.**

The technical specifications required are extremely **precise and demanding**.

However, according to **EUROCODE2**, a simple steel overlap is sufficient for construction purposes.

To date, no certification exists for testing and securing these overlays.

The paradox is obvious: if the mechanical splice doesn't pass the tests, all you have to do is simply overlap the bars, and the construction is compliant.

OVERLAP
=
NO CERTIFICATION

MECHANICAL SPLICES
=
INTERNATIONAL CERTIFICATIONS

QUALITY

TRACEABILITY

RELIABILITY

RESISTANCE

PRODUCTIVITY

SUPERIOR SAFETY

Reinforcing bar overlapping and mechanical splices are two quite distinct techniques. They differ significantly in terms of performance and reliability, particularly in the event of impact.

Overlapped **mechanical splices** transfer the load directly through the concrete. This method involves overlaying the bars over a certain length, where the concrete plays a crucial role in transmitting forces.

However, this technique has one major weakness : in the event of impact, the structure loses its integrity and often breaks at the overlaps, jeopardizing the stability of the whole.

OVERLAP

MECHANICAL SPLICES

In contrast, threaded mechanical splices with a coupler offer a much more robust solution. Here, the load is transferred directly by the mechanical connection of the coupler, which firmly fixes the rebar together.

In the event of an impact, the coupler guarantees the integrity of the structure, as it provides the same mechanical characteristics as a continuous reinforcing bar along its entire length.

In this way, mechanical splices maintain structural cohesion and performance, even under dynamic loads, offering superior reliability for projects requiring high safety standards.

AN ECONOMIC ADVANTAGE

When it comes to price, the two solutions also differ :

Traditional overlapping has a variable final cost, influenced by the preparations required on site, or the price of steel.

By contrast, mechanical splices offer a fixed final price, thanks to their standardized manufacturing cost and controlled installation, ensuring cost predictability and consistent performance.

OVERLAP

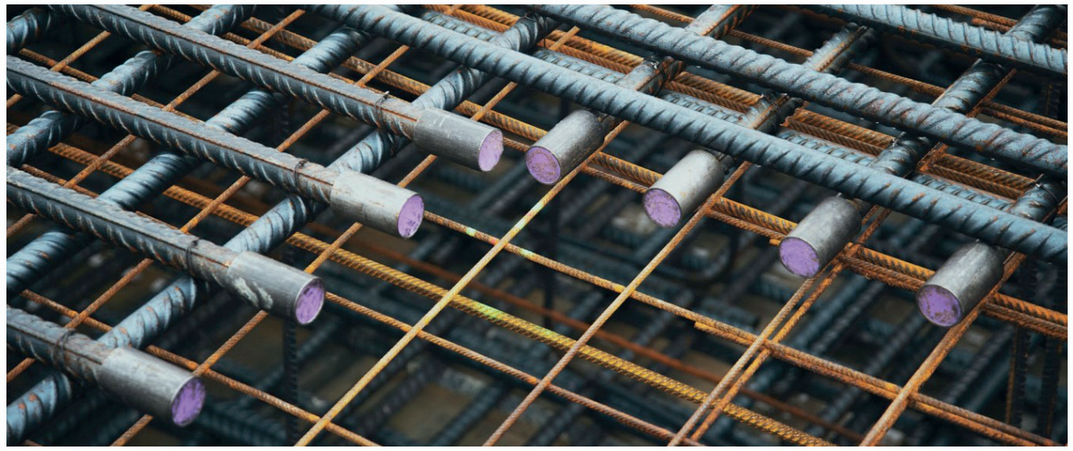
- Additional rebar volume
- Formwork preparation
- Transport brackets
- Longer construction
- The cost of steel can vary
- Longer operations
- Steel rod

*The end-user price is **variable !***

MECHANICAL SPLICES

- 1 coupler
- 2 threaded bars

*The end-user price is **fixed !***

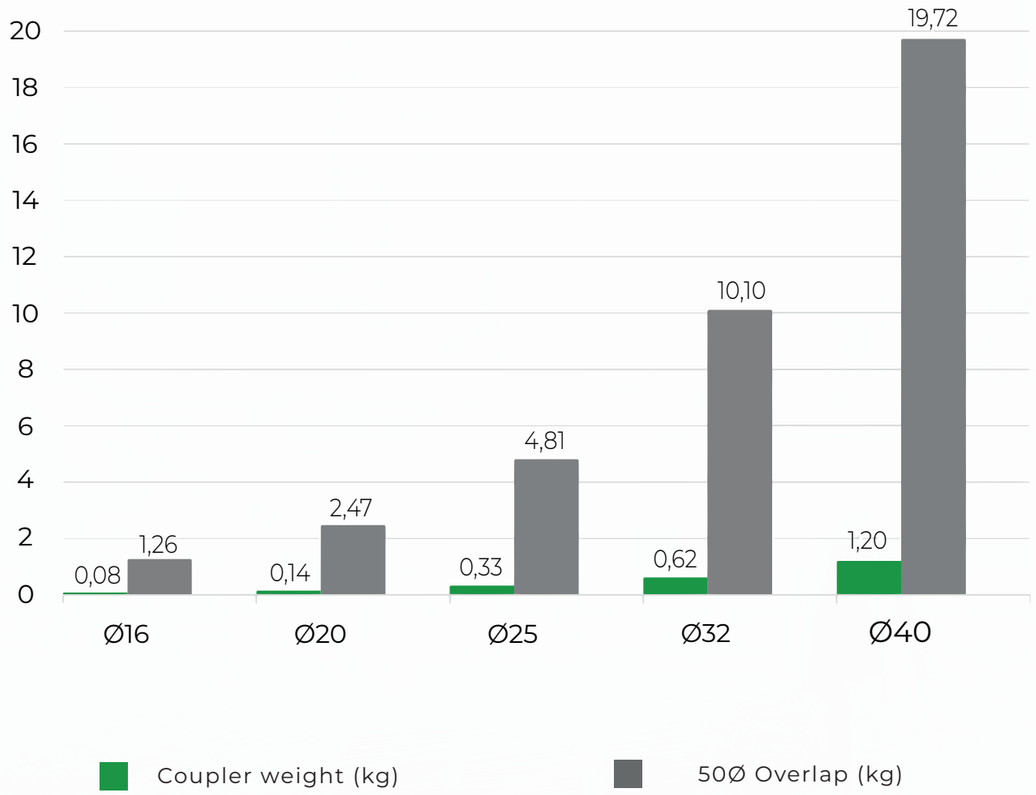


A WEIGHTY ADVANTAGE

As we saw earlier, overlapping reinforcing bars is the most traditional way of connecting them together. It's a method that's been in use for over 50 years.

For each overlap, an average length of rebar should be around 50 times the diameter of the bar.

This entire overlap length can be replaced by a much lighter coupler, which ensures the continuity of the rebar.



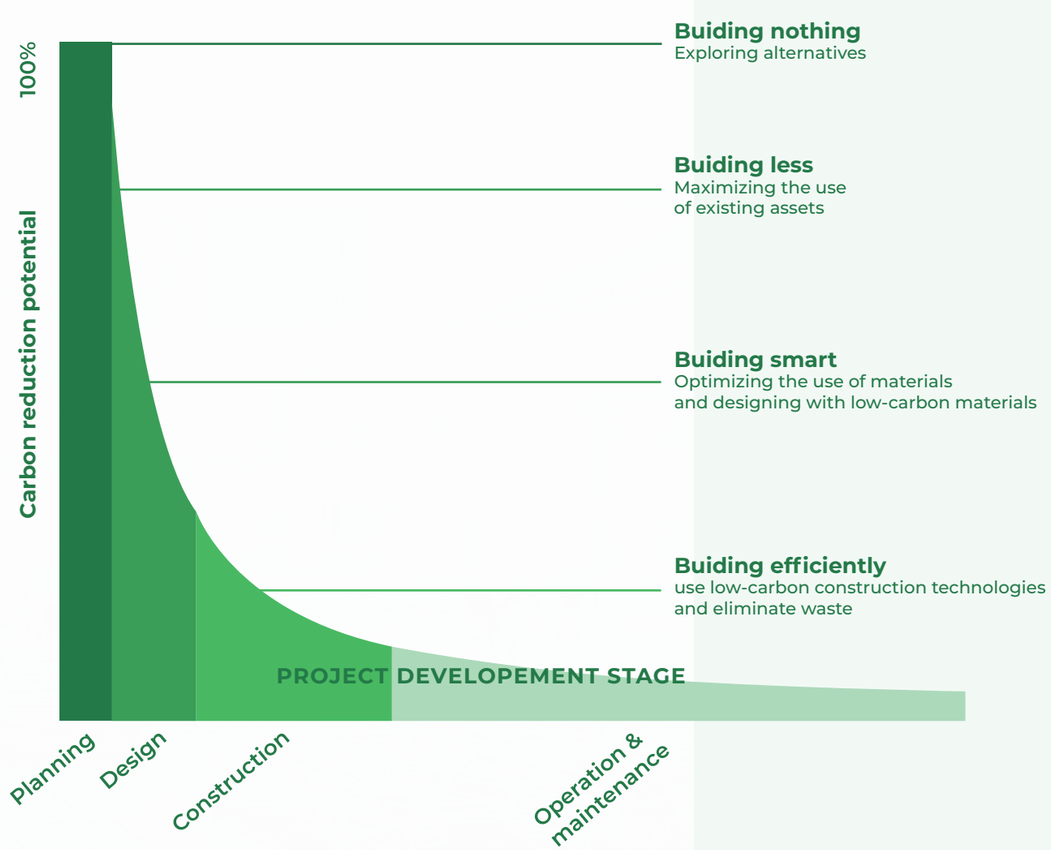
REDUCING CARBON FOOTPRINT AT THE DESIGN STAGE

During the design phase of a project, the influence on the reduction of carbon emissions is greatest !

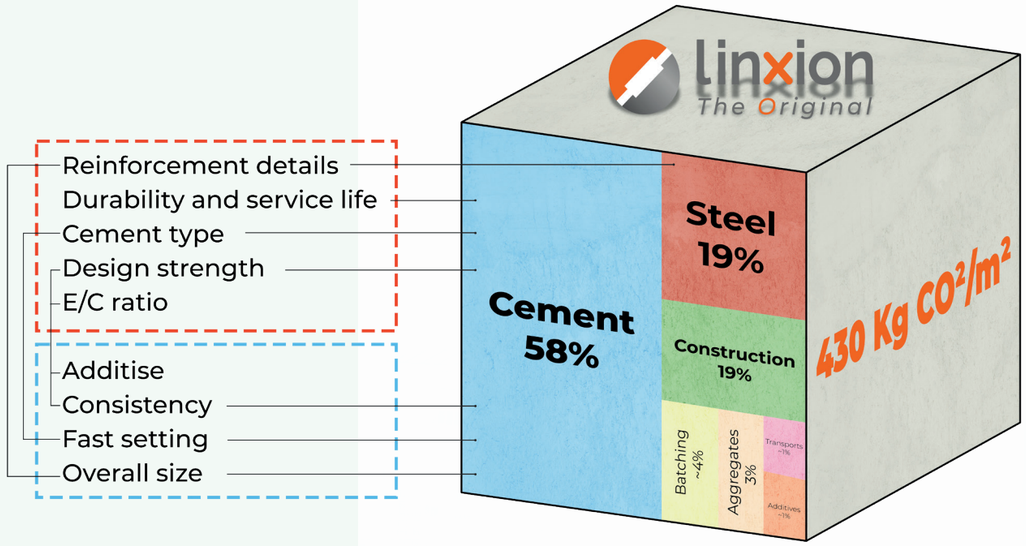
The challenge is to find structural solutions that are highly ecologically efficient, while respecting standards and structural safety.

Mechanical splices, for example, eliminate the causes of inefficiency associated with overlapping, such as over-consumption of steel and cost variability, while offering a new, more durable and predictable solution.

In this way, splices contribute to the significant reduction of carbon emissions in construction projects!



If we zoom in on a reinforced concrete structure to see the distribution of carbon incorporated in each element present, we have the following composition:



However, we have seen that it is possible to reduce steel consumption by 20% in a large project by using mechanical splices...

And that the corresponding proportion of steel in a reinforced concrete structure is around 19%.

20% OF **19% SIGNIFIE :** NEARLY **4% IMMEDIATE REDUCTION IN CARBON INCORPORATED** INTO EVERY REINFORCED CONCRETE CONSTRUCTION

CASE STUDY : GRAND PARIS EXPRESS

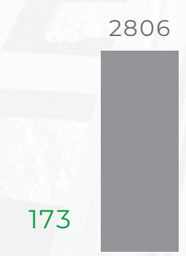
ONE OF THE ***LARGEST INFRASTRUCTURE*** PROJECTS IN FRANCE

The Grand Paris Express is a **public transport** network project comprising four automatic metro lines around Paris, and the extension of two existing lines, creating **200 km** of new track.

LINXION The Original delivered **320,000** couplers in 2021.

The Bartec/Linxion mechanical splices have enabled significant **savings in steel** consumption.

DIFFERENCE IN TOTAL STEEL USED IN TONNES

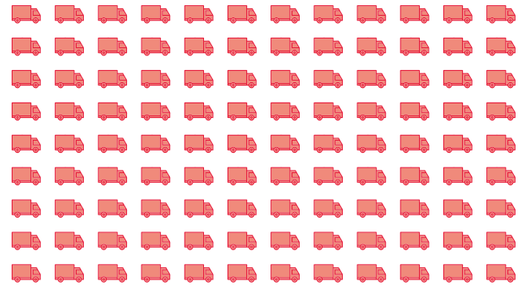


or
16 X less
steel used

and
less 4 871
tons de CO_2

WITH COUPLERS
8 TRUCKS

WITHOUT COUPLERS
108 TRUCKS



LONG-TERM RISKS

Every construction project must guarantee the safety of everyone before, during and after its implementation.

From the safety of the worksite and its personnel, to the surrounding infrastructure, respect for the environment and the people who live or move around it.

All types of incident must be **avoided**, whether inherent to the construction site itself, or due to the consequences of miscalculations or material defects in the structure.

Large-scale projects (bridges, stadiums, freeways, airports, metro lines, high-rise buildings, nuclear power plants, etc.) have a **major impact** on public spaces, which means that a structural failure could result in a large number of casualties.

This is why, after the fact, **maintenance must guarantee the safety and longevity of the building.**

TODAY, ***MECHANICAL SPLICES*** ARE MAINLY USED FOR PROJECTS WHERE A STRUCTURAL ***FAILURE*** COULD LEAD TO A ***MAJOR DISASTER*** INVOLVING CASUALTIES

1

Public structures

Skyscrapers, stadiums, landmark buildings

2

Infrastructures

Viaducts, bridges, metro lines, platforms

3

Energy production

Nuclear power plant, windmills

STRUCTURAL STRENGTH AND DURABILITY

Finally, once the building is complete, it needs to **stand** the test of time, unaffected by the **natural elements**. Only the choice of **appropriate materials** can prevent rapid deterioration.

Structures are designed **to withstand** the test of time, even in harsh environments such as seismic zones. There's no room for inaccuracy: products must **perform** to expectations.

ISSUES AND PRECAUTIONS IN PRODUCT SELECTION

As mentioned above, the choice of mechanical splices represents a significant advance over traditional overlapping technique.

However, it is crucial not to overlook the inherent variability of each type of mechanical splices !

Pont MORANDI - Italie

Today, a large number of products, similar at first sight, are manufactured according to different criteria of precision, control and quality. This can lead to confusion as to their true value.

Although approvals from international certification bodies guarantee safe, compliant use, in some cases, the product delivered to the site no longer corresponds to the certified one, without being able to differentiate it with the naked eye, for budgetary reasons.

In these cases, decision-makers need to carry out additional checks to ensure that the products used on site comply with the regulations!

COUPLERS DIFFERENCES

RAW MATERIAL

FOR LABORATORIES AND CERTIFICATION

To manufacture the couplers that will be used for the rebar bonding samples to be sent to the laboratories.

Producers use seamless 40Cr tubes made from materials of the highest technical quality in terms of elongation and strength.

FOR CONSTRUCTION SITE

Once the order has been taken, the raw material used is often heat-treated #45C, which is much less expensive but has poorer mechanical properties.

Tubes are cut in large bundles, with random precision. Couplers supplied on site are often not made from the same raw material, but from a cheaper one.

Sometimes, they don't even have exactly the same design or dimensions.

PRODUCTION MACHINERY

FOR CERTIFICATION

To manufacture the couplers to be sent to the laboratories (which will be used for rebar connection samples), the manufacturers use highly precise CNC machines to thread the couplers.

FOR CONSTRUCTION SITE

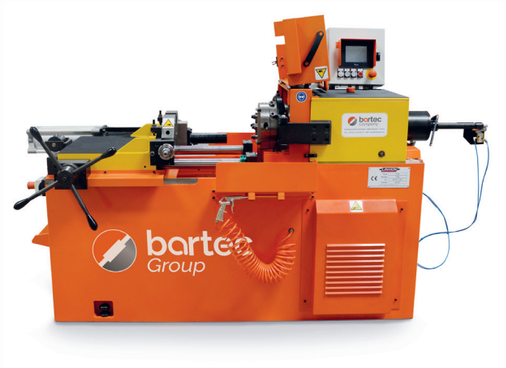
The machines used are simple tapping machines with a much less expensive but much less precise process.

DIFFERENCES ON THREADING MACHINES

MACHINERY

FOR LABORATORIES AND CERTIFICATION

To thread the rebar for the rebar bonding samples to be sent to the laboratories, manufacturers use expensive, high-precision machines. In this way, they can be sure of passing the tests.

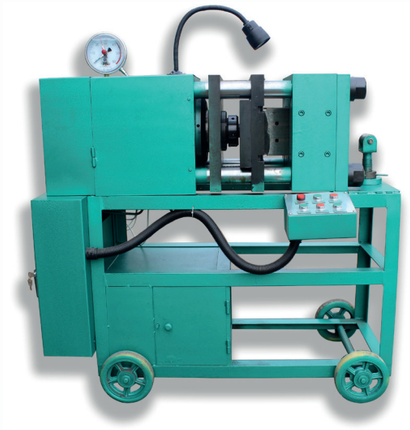


FOR CONSTRUCTION SITE

Once the order has been taken, the machines supplied on site are the cheapest, unreliable ones with random precision. The machines used to produce the threads are never the same, even mixing several types of machine.

There is no certification for the machines used on site.

Because of the reliability of the different machines, on-site thread production is not stable and regular.



DIFFERENCES IN THE MANUFACTURE OF MECHANICAL SPLICES

IMPLEMENTATION PROCEDURES

FOR LABORATORIES AND CERTIFICATION

The samples are manufactured by fully-trained technicians, and the connection is checked in all its dimensions using inspection tools and manufacturing quality processes. The assembly procedure is perfectly followed.

The result is a bond that can pass certification tests.

FOR CONSTRUCTION SITE

Very often, workers have no special training or certification to make threads.

No production controls are carried out, no dimensions are checked, no assembly procedures are provided, let alone followed. The couplers that screw onto the two bars are sufficient to assume that the connection is compliant.

WHAT ABOUT CERTIFICATION IN THESE AREAS?

Most certifications do not take into account the raw materials used or the production machinery.

CONCLUSION

INNOVATION FOR SUSTAINABILITY AND SAFETY

This manifesto is part of a global reflection on the evolution of construction practices, particularly in the field of reinforced concrete.

The traditional approach to cladding, although tried and tested, has overall limitations in terms of safety, performance and durability.

The STARS vision, aware of today's challenges, offers an innovative alternative: rebar connections with couplers. A certified, robust and environmentally-friendly process!

STARS MEETS THE CHALLENGES OF MODERN CONSTRUCTION THAT ARE SAFER, MORE ECONOMICAL AND LESS POLLUTING.

Far from being a mere technical evolution, mechanical splice technology represents a breakthrough in the way we think about the junction between steel bars.

It offers substantial advantages over overlapping:

WE ALSO HIGHLIGHT THE CRITICAL ISSUES INVOLVED IN CHOOSING PRODUCTS AND EQUIPMENT.

The heart of the process lies in the couplers, whose quality and compliance with standards determine the reliability of the mechanical splices.

There are three aspects to consider :

- **DIFFERENCES BETWEEN COUPLERS :**

Mechanical performance varies according to the type of coupler chosen (standard, high-performance, seismic, etc.). It's crucial to select the right products for your project.

- **THREADING MACHINES AND MANUFACTURING PROCESSES :**

Poorly executed or non-compliant threading can seriously compromise the system's efficiency. The same applies to manufacturing tolerances, which must be strictly controlled.

- **CERTIFICATION AND PREREQUISITES :**

Compliance with local and international standards, such as the Eurocode or ACI standards, is essential to guarantee the safety of structures and benefit from the advantages of the process.

This manifesto shows that mechanical splices are much more than a simple substitute for overlapping :
they embody a new approach to construction, geared towards performance, durability and safety.

However, these benefits can only be fully realized with complete technical control, a rigorous choice of materials and implementation that complies with the strictest standards.

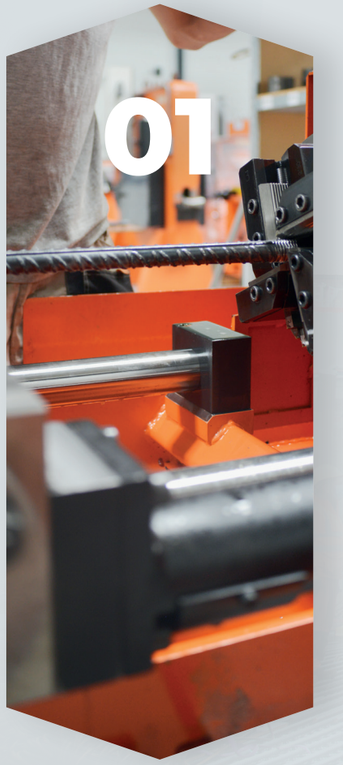
The future of construction lies in innovation and responsibility. STARS is committed to promoting solutions in which every player is involved, so that mechanical splices become the foundation of a new era in civil engineering, where quality, economy and ecology converge to build a more resilient and sustainable world.

linxion
The Original

CREATOR OF TECHNICAL SOLUTIONS FOR REINFORCED CONCRETE

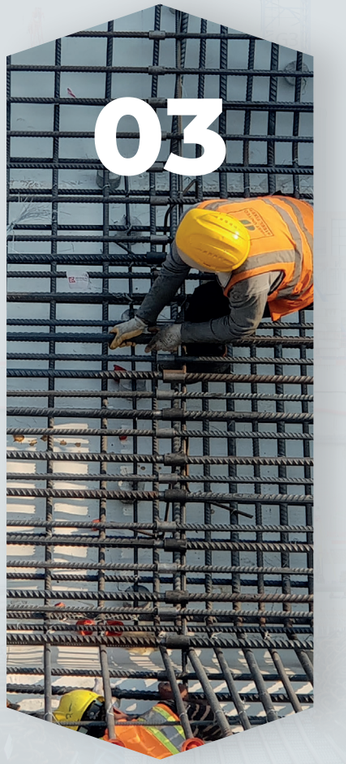
SINCE 1994

Mechanical splices by LINXION The Original of BARTEC : a guarantee of safety above all else ! As specialists in the design and engineering of technical solutions for reinforced concrete, we have become a standard for reliability in the field of mechanical splices.



INNOVATIVE KNOW-HOW

EASY IMPLEMENTATION



QUALITY & SAFETY

OUR COMMITMENTS

All our couplers are marked to identify the raw material, place and date of manufacture. This enables us to provide you with certificates of conformity indicating the maximum mechanical characteristics to which each coupling can be subjected.

LINXION The Original of BARTEC is audited and approved by certification bodies worldwide. They accompany the group through audit programs to ensure the continuous improvement of our organization and our products, with a view to meeting your requirements.

LINXION The Original of BARTEC can help you with any type of certification or product development project linked to standards requirements.

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bartec by linxion | cergil by linxion | linxion International

LINXION The Original
355 Avenue Henri Schneider 69330 MEYZIEU | France
+33 (0) 427 349 515 | www.linxion.com