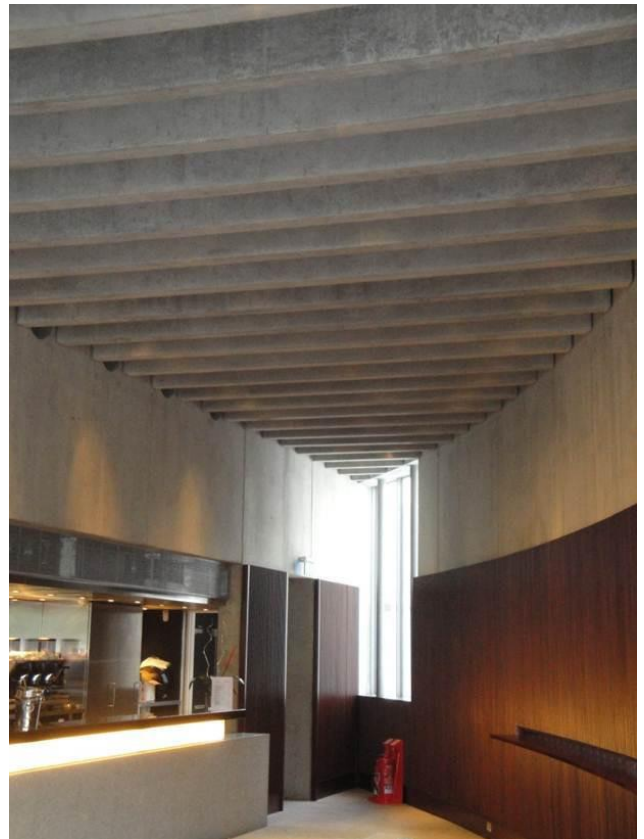


INVISIBLE CONNECTIONS



PRECAST CONCRETE CONNECTIONS





Invisible Connections Ltd is the UK partner of Norwegian company, Invisible Connections™, specialists in ‘unseen’ structural connections for precast stair landings, and other structural connections for precast concrete frames and structures.

The Invisible Connections range of telescopic connectors was developed to solve the problem of unsightly support systems for precast slabs and beams (e.g. traditional bracketry and/or corbel support details).

The range is in three product groups:

TSS & RVK

Primarily intended for precast stairs and landings, there are two standard capacities; 40 kN & 100 kN. They are also useful for conditions other than stairs (see pages 3-5).

DTS

This natural extension of the TSS range offers capacities up to 150 kN, making DTS connectors ideal for smaller beams or heavy slabs.

BSF

These connectors are designed for heavy-duty beam supports, with capacities from 225 kN to 700 kN. By using pairs of connectors, loads up to 1400 kN can be catered for.

The capacities stated above (for all connectors) are resistances to factored loads (1.5 x live load, 1.35 x dead load). The Invisible Connections range of telescopic connectors is manufactured in Norway, using state-of-the-art robotic machinery.

Design is in accordance with the following standards:

- Eurocode 2: Design of concrete structures Part 1-1 General rules and rules for buildings.
- Eurocode 3: Design of steel structures Part 1-1 General rules and rules for buildings.
- Eurocode 3: Design of steel structures Part 1-8 Design of joints.

Steel is grade S355 (minimum)

All products are covered by appropriate European Technical Approvals, based on testing at SINTEF - the largest independent research organisation in Scandinavia.



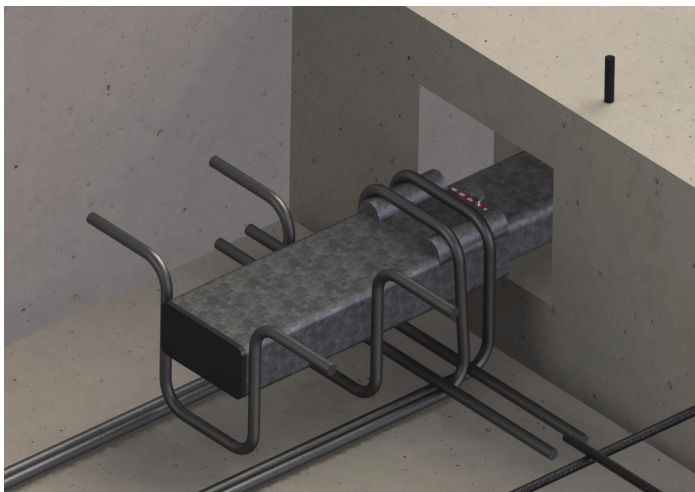
The complete range of telescopic connectors from Invisible Connections has full ETA certification and CE marking as required by EC2.

<p>SINTEF Building and Infrastructure P.O. Box 4700 Sluppen NO-7057 Trondheim Tel: +47 73 39 39 00</p> <p>Authorised and certified according to Article 19 of the Council Directive 89/100/EEC of 21 December 1989 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products.</p> <p>European Technical Approval</p> <p>Trade name: DTF and DTS corbs</p> <p>Holder of approval: SB Prosjekt AS Osna Veit NO-4300 Aulhusen Norway</p> <p>Generic type and use of construction product: Corbel free, load carries</p> <p>Valid from: 31.05.2013 Valid to: 31.07.2018</p> <p>Manufacturing plant: SB Prosjekt AS Osna Veit NO-4300 Aulhusen Norway</p> <p>This European Technical Approval consists: 84 pages including 5 h of the document</p> <p> European Organisation for Technical Approvals</p>	<p>SINTEF Building and Infrastructure P.O. Box 4700 Sluppen NO-7057 Trondheim Tel: +47 73 39 39 00</p> <p>Authorised and certified according to Article 19 of the Council Directive 89/100/EEC of 21 December 1989 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products.</p> <p>European Technical Approval</p> <p>Trade name: BSF beam connections</p> <p>Holder of approval: SB Prosjekt AS Osna Veit NO-4300 Aulhusen Norway</p> <p>Generic type and use of construction product: Corbel free, load carrying beam</p> <p>Valid from: 29.06.2013 Valid to: 29.06.2018</p> <p>Manufacturing plant: SB Prosjekt AS Osna Veit NO-4300 Aulhusen Norway</p> <p>This European Technical Approval consists: 152 pages including 9 Annexes part of the document</p> <p> European Organisation for Technical Approvals</p>	<p>SINTEF Building and Infrastructure P.O. Box 4700 Sluppen NO-7057 Trondheim Tel: +47 73 39 39 00 Fax: +47 73 39 39 00</p> <p>Authorised and certified according to Article 19 of the Council Directive 89/100/EEC of 21 December 1989 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products.</p> <p>European Technical Approval ETA-11/0346</p> <p>Trade name: RVK and TSS staircase connections</p> <p>Holder of approval: SB Prosjekt AS Osna Veit NO-4300 Aulhusen Norway</p> <p>Generic type and use of construction product: Connections for precast concrete staircase and landing elements to the stairway walls.</p> <p>Valid from: 25.01.2012 Valid to: 25.01.2017</p> <p>Manufacturing plant: SB Prosjekt AS Osna Veit NO-4300 Aulhusen Norway</p> <p>This European Technical Approval consists: 49 pages including 13 Annex which forms an integral part of the document</p> <p> European Organisation for Technical Approvals</p>
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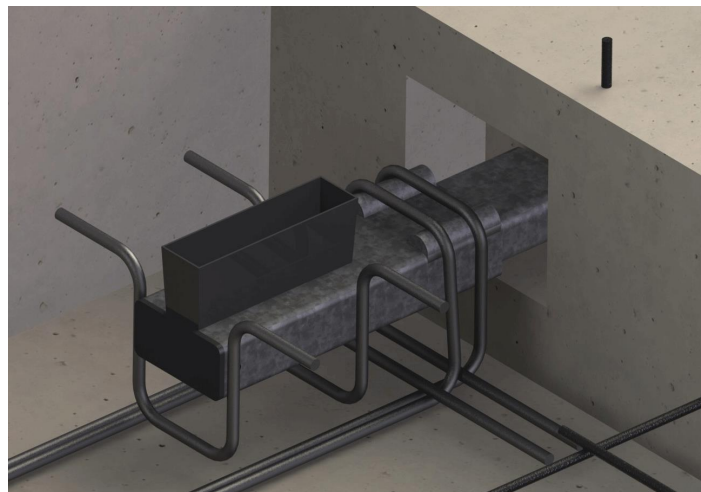
TSS & RVK stair support connectors

Traditionally, precast slabs such as stair landings used to be supported by a steel angle bolted to the wall. Installation was slow, required high degrees of accuracy, tied up the crane with costly hook-time and could only be used on straight walls.

The TSS and RVK range of connectors was developed specifically to address these and other needs. Just check the pros and cons below and make up your own mind.



TSS telescopic connector



RVK telescopic connector

The Architect gains a smooth obstacle-free soffit with no supports on show

The Engineer gains a robust, simple and efficient connection, which can also be used to satisfy robustness

The Insitu Contractor does not need to incorporate connections into the wall requiring tight tolerance

The Precaster keeps control of the connection within the factory, with no need for specialist operations on site

The Main Contractor gains reduced crane hook-time requirements, and rapid provision of access stairs

The pros and cons - Why do it any other way?

Bolted-on angle

- Installation of bolts is costly
- Accurate positioning of bolts required
- Large/long angle requires crane
- Drilling may hit reinforcement
- Large clearance gap required for bolts/nuts
- Tools required to install bolts
- Pre-installed angles obstruct stairwell for following trades
- Shimming/adjustment is done from below slab
- Fire protection required
- Visual treatment required
- Difficult to install on curved walls

TSS/RVK

- No bolts required
- Void in wall provides ample tolerance
- No angle = No crane
- Wall voids formed between reinforcement
- Tolerance gap only is required
- No tools required
- No obstructions = clear route for following trades
- All operations are from above
- Connectors automatically fireproofed after grouting
- Connectors are concealed from view
- Handles any shape

Capacities (connectors may be used in pairs for even higher load requirements):

TSS41 = 40kN TSS101 & RVK101 = 100kN

TSS & RVK connectors are not limited to being used only in stair situations, as these examples show:



RVK connectors in these large architectural beams allowed complex connections with no corbels.

TSS connectors 'on-edge' in these beams allowed corbel-less spanning between curved supports.

At the London 2012 Olympic Athletes Village, TSS connectors supported bridge decks between accommodation blocks.



TSS connectors are the ideal method of stabilising parapets against vehicle impact, with no connection left on view. BSF connectors provide the vertical support.

TSS & RVK - further benefits

TSS & RVK telescopic connectors have a number of additional benefits:



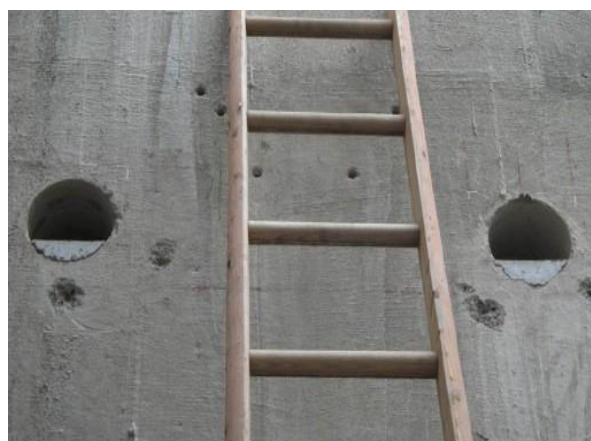
Using RVK and TSS connectors enables architects to maintain clean lines, and provide a more aesthetic appearance.



TSS connectors being used in a curved concrete unit - demonstrating the greater flexibility provided.



TSS and RVK connectors can be used in pairs to allow higher, concentrated loads in certain areas.



Retro-fit can be achieved by core-drilling walls to receive telescopic connectors.

Robustness

UK Regulations require that all precast floor and stair elements are anchored to the main structure to provide robustness in the event of an incident. Traditionally this involved dowels or other mechanical connections into the walls, meaning more work and cost on site.

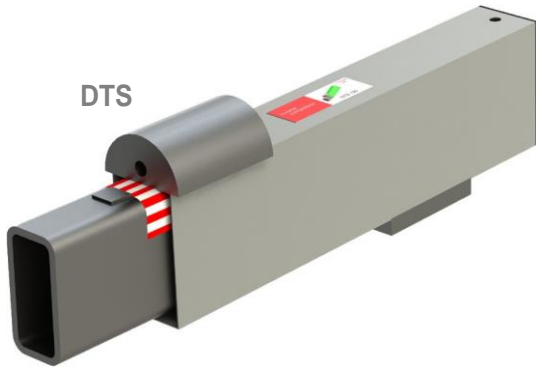
Recent techniques developed by Invisible Connections Ltd now mean that TSS and RVK telescopic connectors can normally provide this anchorage without the need for any other connections. Where the layout allows, a simple repositioning of the connector may be the answer (usually providing a 'zero cost' solution). In this case, the connectors are designed to work laterally in addition to carrying the vertical loads. Alternatively, where the layout dictates, specially modified RVK connectors can also provide axial anchorage, despite comprising sliding elements.

Contact Invisible Connections Ltd for more details on how to best accommodate robustness.

DTS & BSF beam telescopic connectors

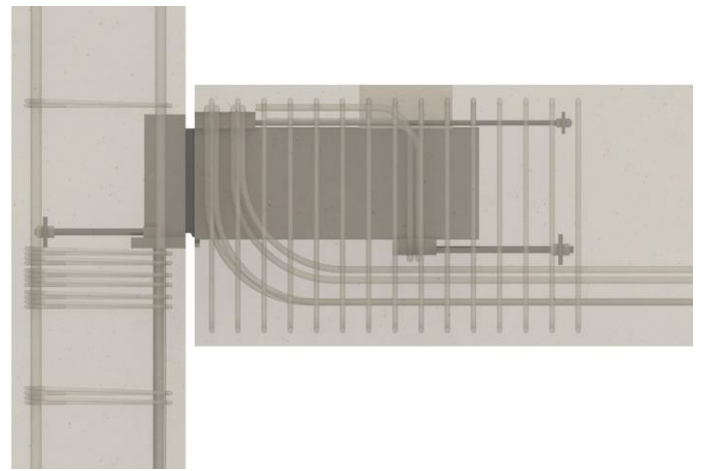
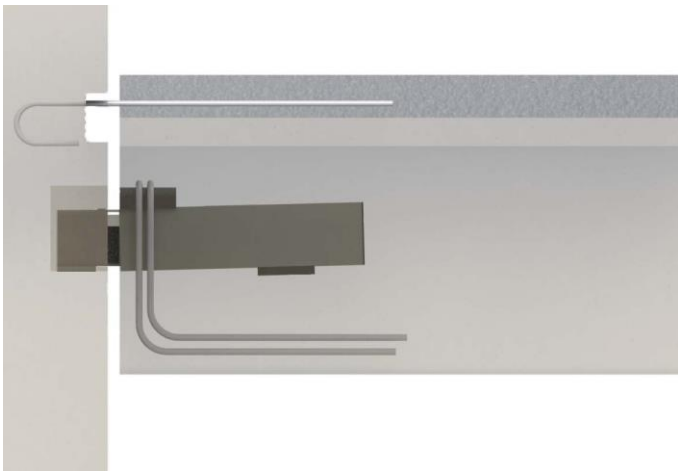
DTS connectors

These are similar in design and usage to TSS connectors, and many of the aforementioned details still apply.



BSF connectors

For heavy loads from beams into columns, walls or other beams, the ideal solution is the BSF system. These are 3-part connectors, but otherwise similar in application principle.



Standard capacities of DTS connectors

Type	Capacity
DTS120	120kN
DTS150	150kN

Standard capacities of BSF connectors

Type	Capacity
BSF225	225kN
BSF300	300kN
BSF450	450kN
BSF700	700kN

All telescopic connectors, from the smallest TSS to the largest BSF, incorporate an integral half-round bearing block, which ensures correct bedding of local reinforcement, avoiding local crushing/cracking.

BSF applications

Traditionally, beams were supported off columns using integral corbels. Apart from being difficult and costly to form in the column, they reduce headroom locally and spoil the appearance.

Using BSF connectors eliminates the need for corbels, leaving a smooth soffit. Round, or odd-shaped columns present no problems.



Traditional corbel design.



Corbel-less BSF design on round column.

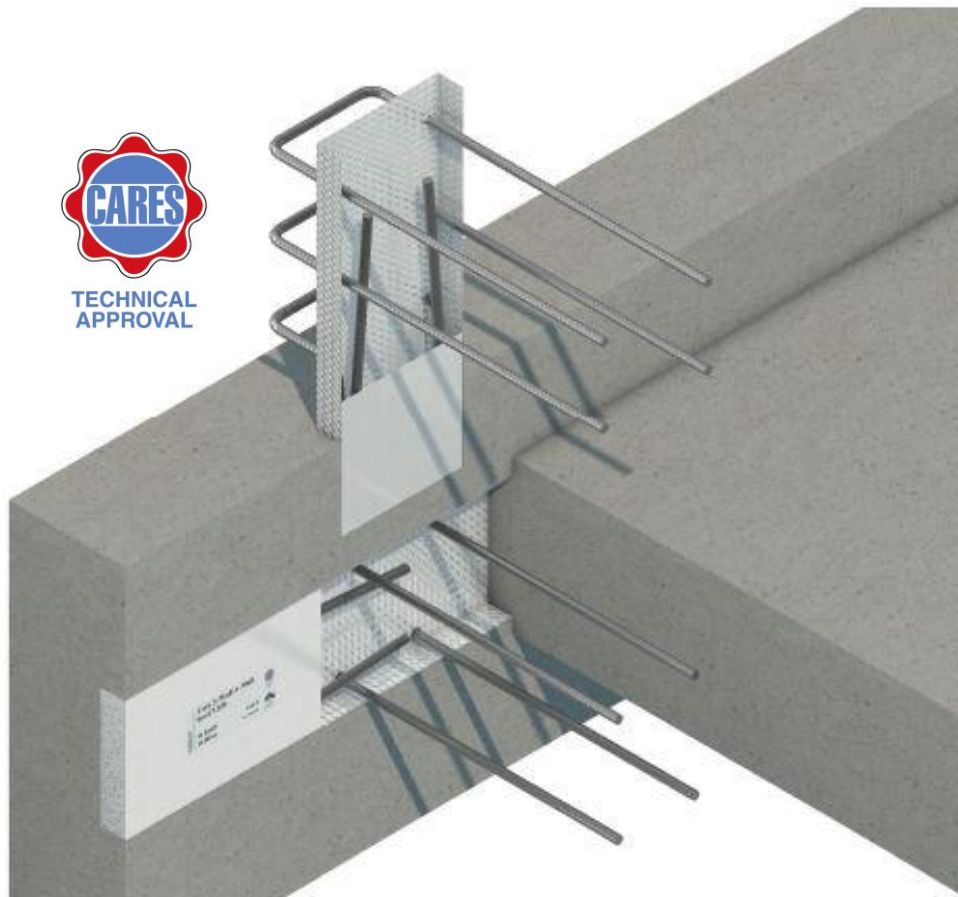


BSF connector in a beam, shown with 'knife' component projecting.



BSF connectors work equally well in beam/beam applications (as well as beam/column).

Also available from Invisible Connections



Another key product by Invisible Connections Ltd is the FERBOX[®] reinforcement continuity system. Unlike any other system available to the UK market, FERBOX casings are bespoke-manufactured in-house (at Thame) to accurately accommodate the specified reinforcement design and joint length (normally without design compromise, cutting or wastage on site). FERBOX is also the first UK product of its type assessed to the requirements of EC2 by UK CARES.



Invisible Connections Ltd

Unit 6 | Thame Forty | Jane Morbey Road | Thame | Oxfordshire | OX9 3RR
Telephone +44 (0)1844 266000 | Fax +44 (0)1844 390167
sales@invisibleconnections.co.uk | www.invisibleconnections.co.uk