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Timber component erection

Connection systems

PhD Tomas Gečys

Associate professor

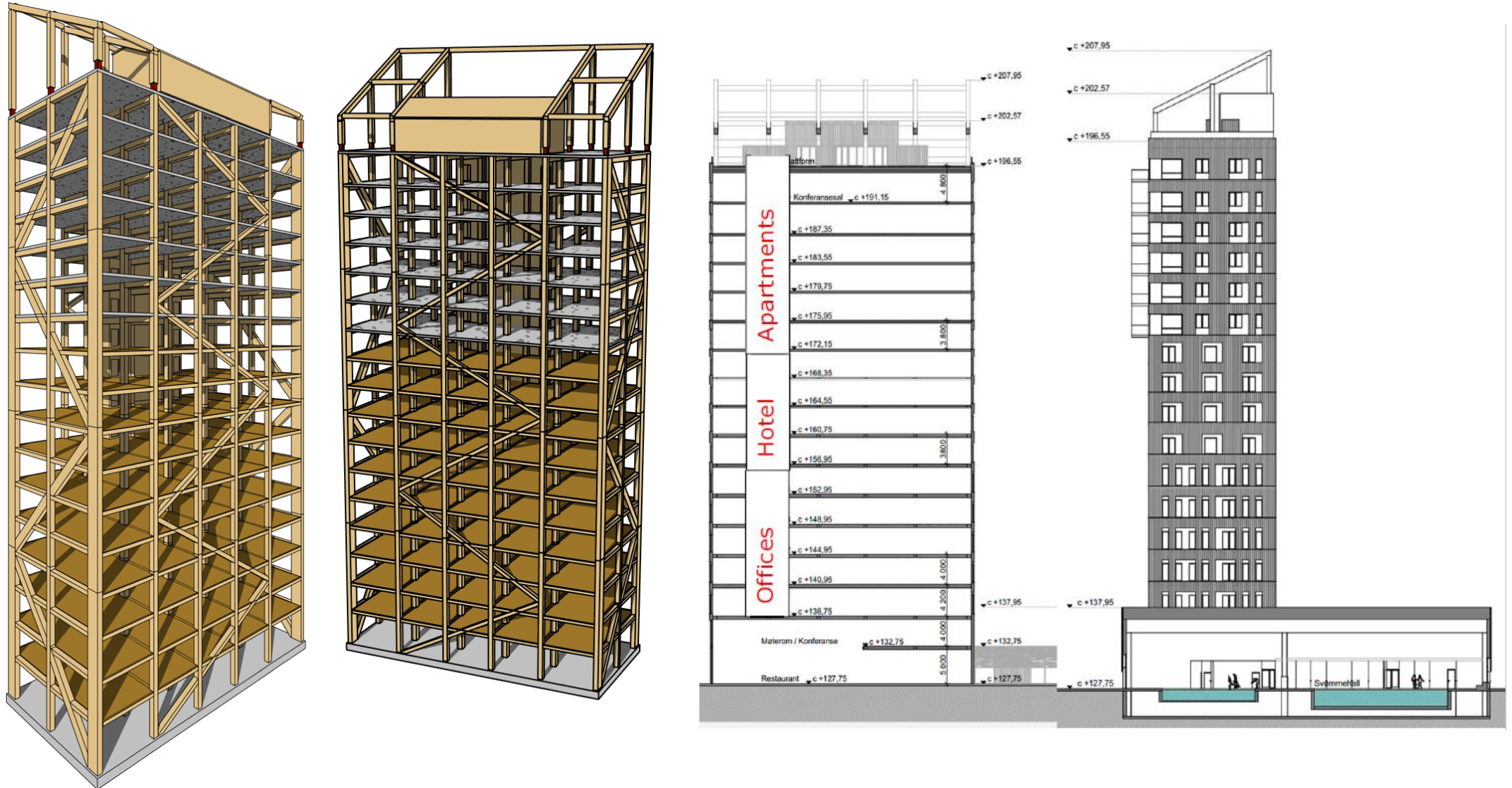
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Main structural types of high-rise timber buildings (Frame system) 1



Mjøsta tower in Norway (source: Forum HolzBau Garmisch 17)

Main structural types of high-rise timber buildings (Frame system) 2



Mjosta tower in Norway (source: Forum HolzBau Garmisch 17)

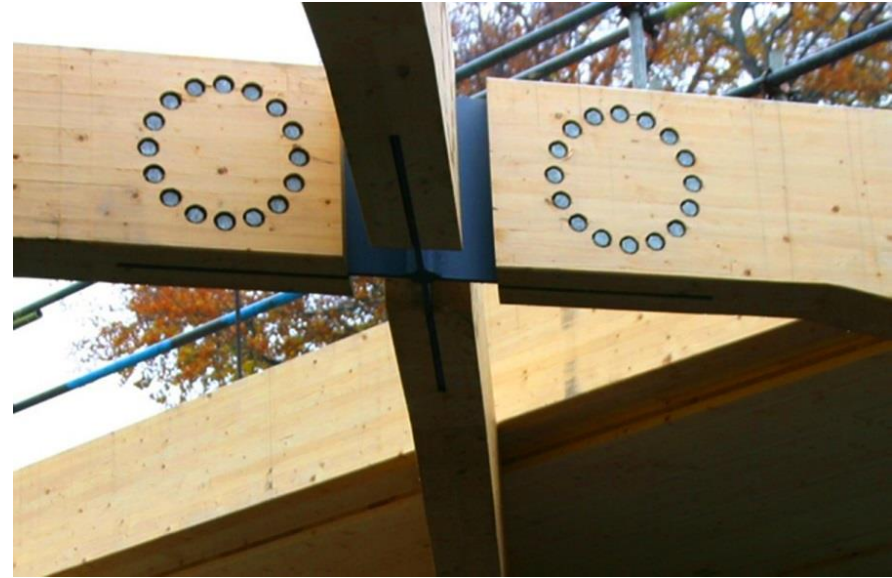
Main structural types of high-rise timber buildings (Frame system) 3



Mjosta tower in Norway (source: Forum HolzBau Garmisch 17)

Main structural types of high-rise timber buildings (Frame system)

Dowels/bolts





Main structural types of high-rise timber buildings (Frame system) Dowels/bolts

Advantages of traditional dowel/bolt types connections:

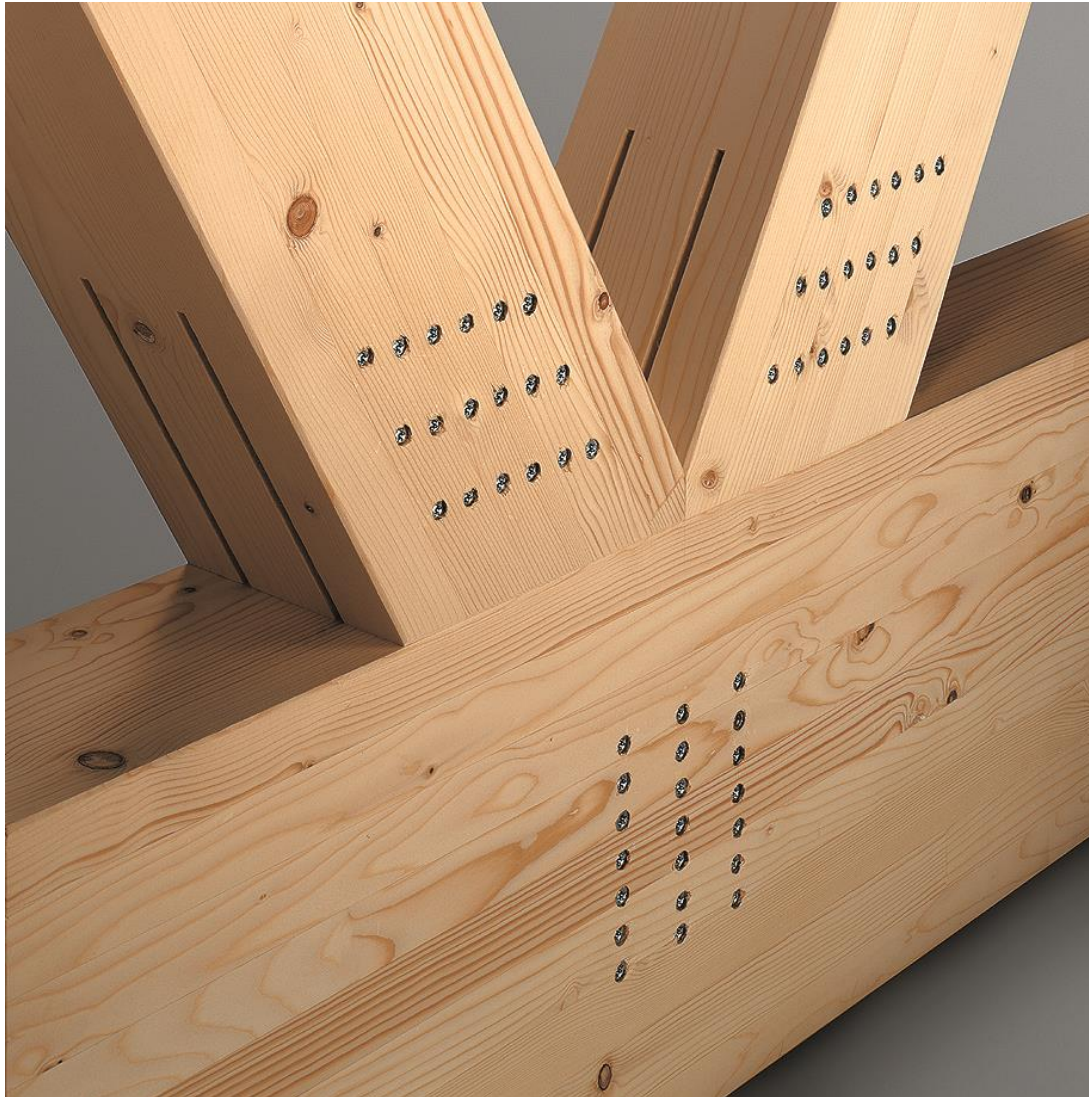
1. Easy and fast installation;
2. Easy to control the assembling process;
3. Elastic-plastic behavior of the connection.

Disadvantages of traditional dowel/bolt types connections:

1. Initial slip of the connection due to the tolerances of production;
2. Fire performance if the steel details are not exposed.

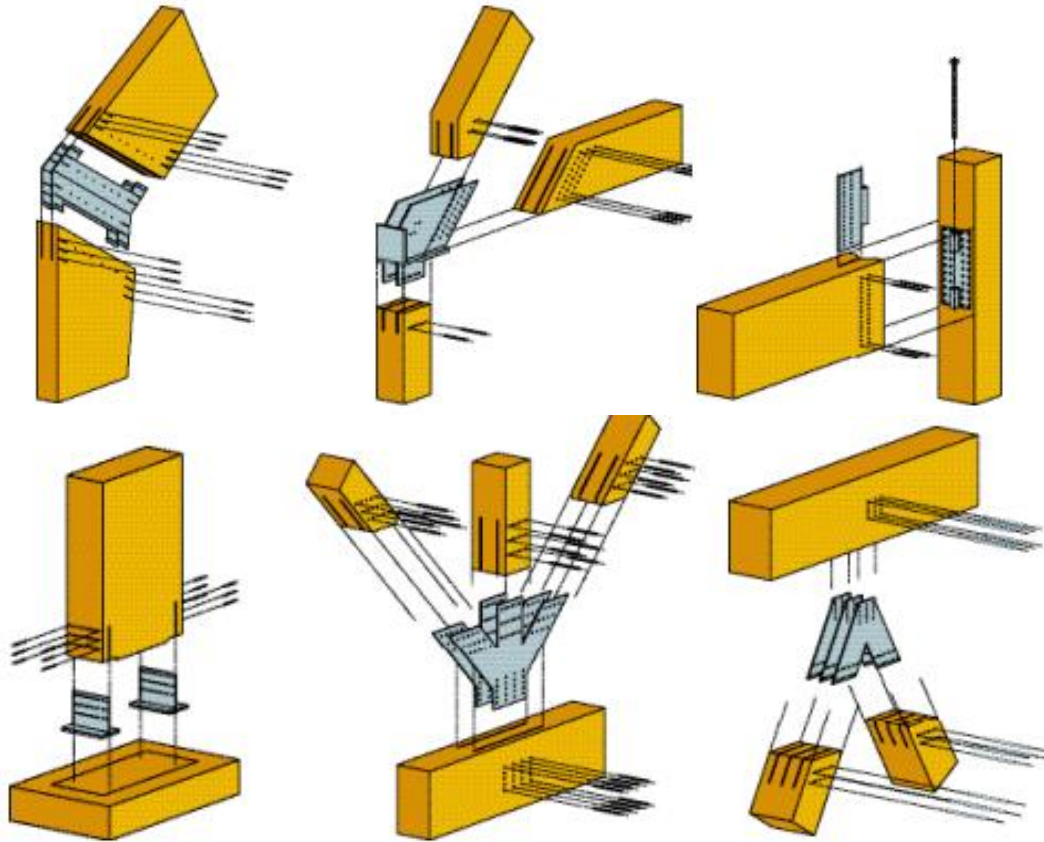
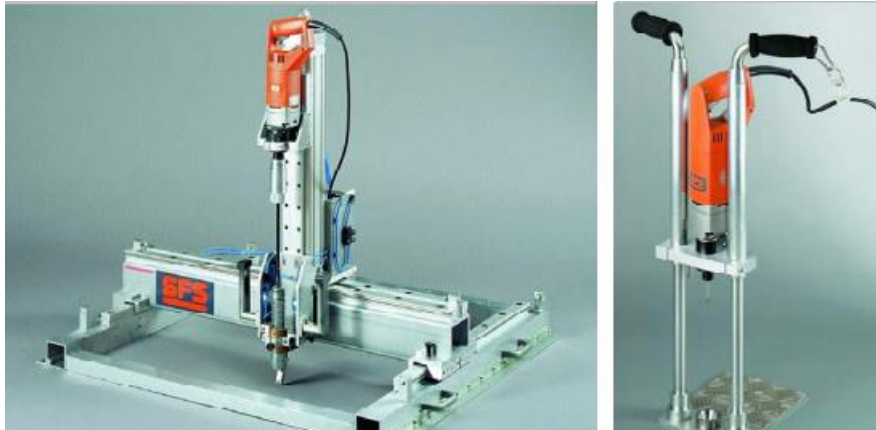
Main structural types of high-rise timber buildings (Frame system)

Self-tapping dowels 1



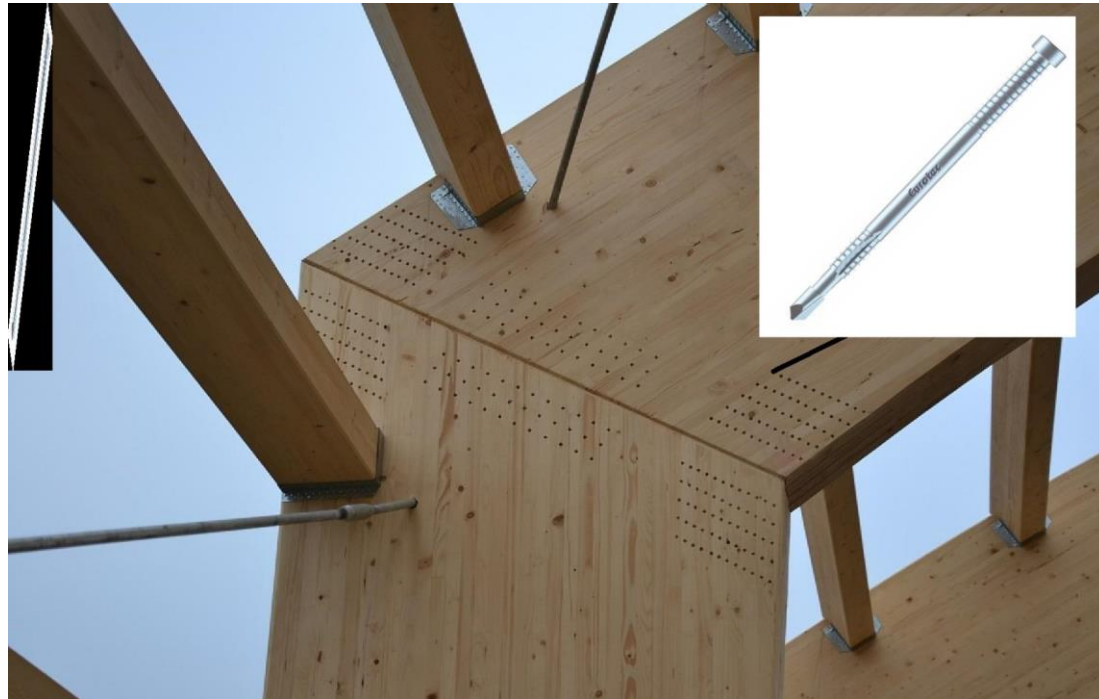
Main structural types of high-rise timber buildings (Frame system)

Self-tapping dowels 2



Main structural types of high-rise timber buildings (Frame system)

Self-tapping dowels 3

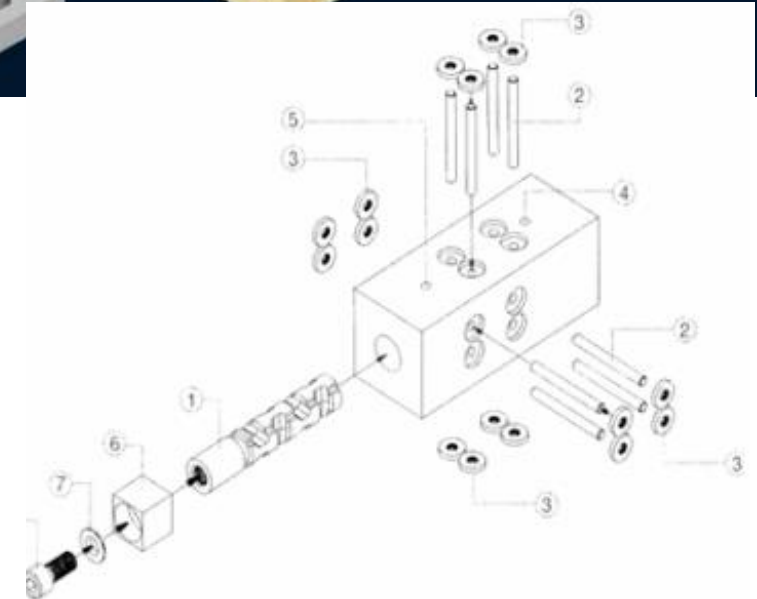
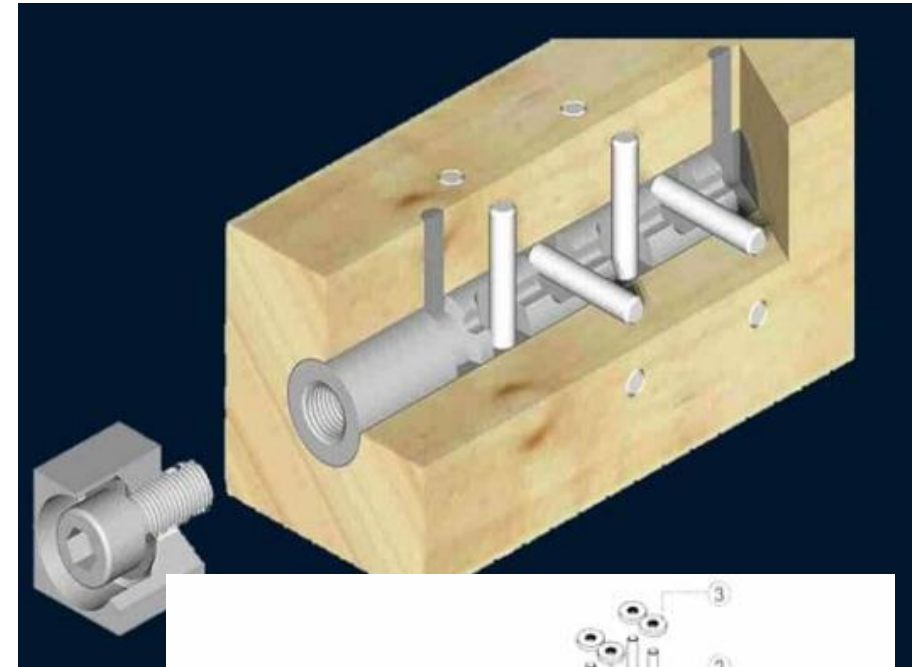
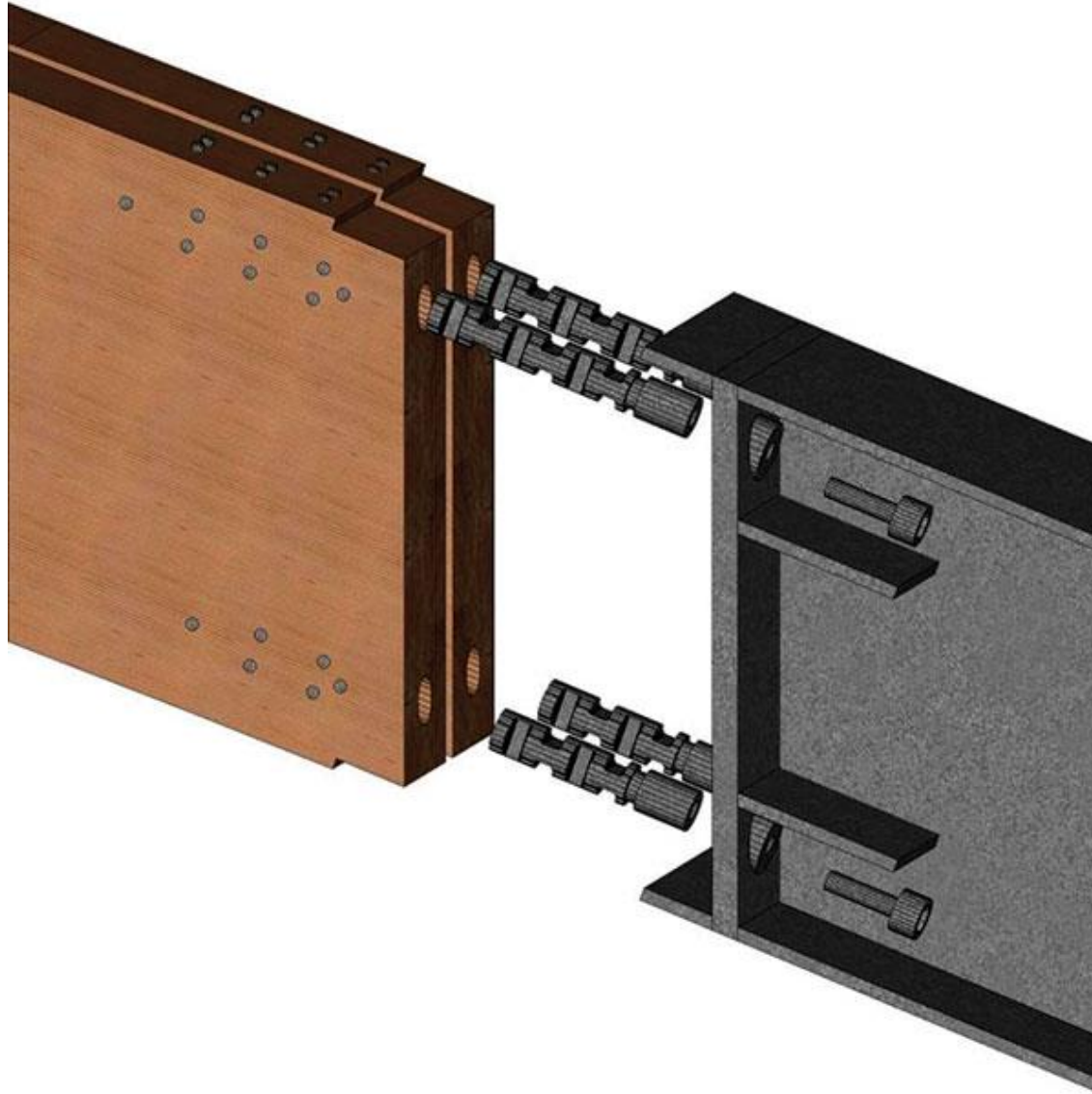


Main structural types of high-rise timber buildings (Frame system)

Self-tapping dowels 4



Main structural types of high-rise timber buildings (Frame system)
Large diameter steel detail anchored with dowels (Bertschie system) 1



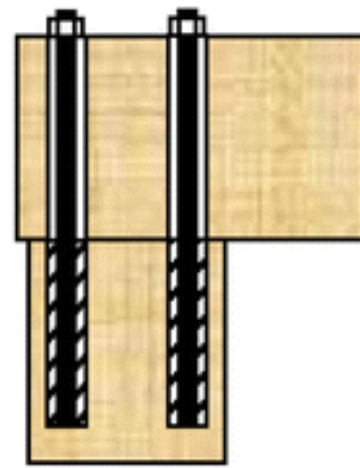


Main structural types of high-rise timber buildings (Frame system) Large diameter steel detail anchored with dowels (Bertschie system) 2

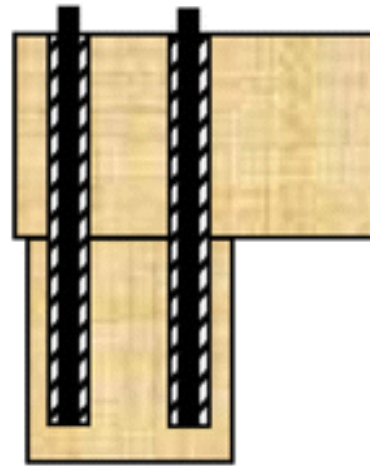


Main structural types of high-rise timber buildings (Frame system)

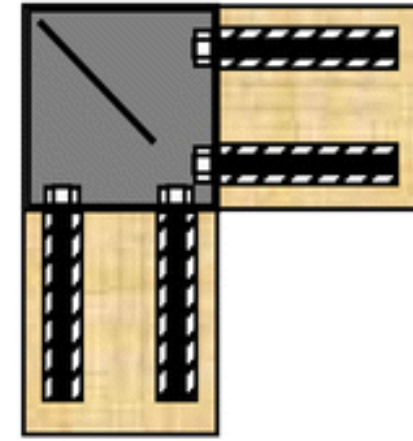
Glued-in steel rods 1



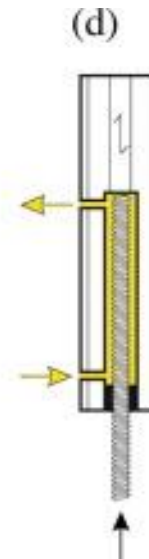
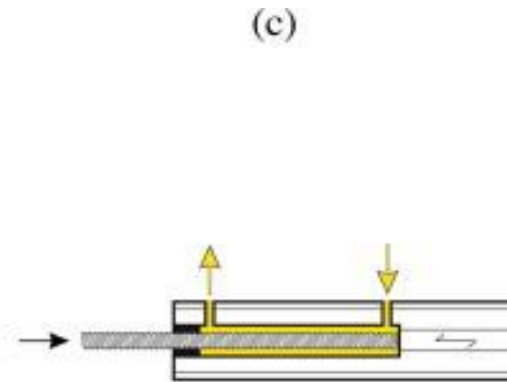
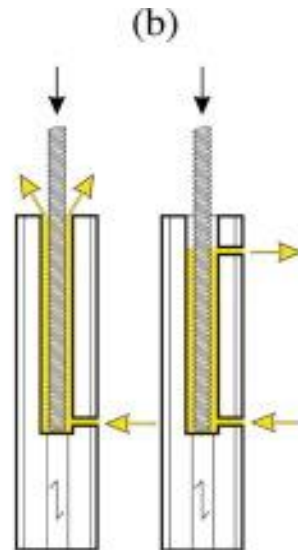
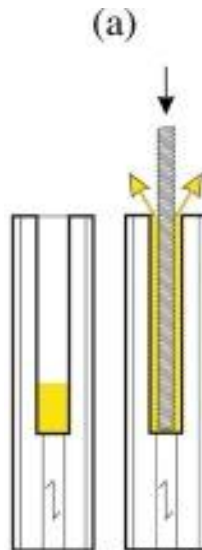
Configuration A



Configuration B



Configuration C



Main structural types of high-rise timber buildings (Frame system)

Glued-in steel rods 2





Main structural types of high-rise timber buildings (Frame system)

Glued-in steel rods 3

Advantages of glued-in steel rods in timber:

1. High stiffness of the connection up to failure;
2. The connection fully installed at the factory;
3. Steel elements may be fully hidden in the timber elements;
4. Elastic-plastic behavior may be reached by gluing the rods at an angle of 45 degrees.

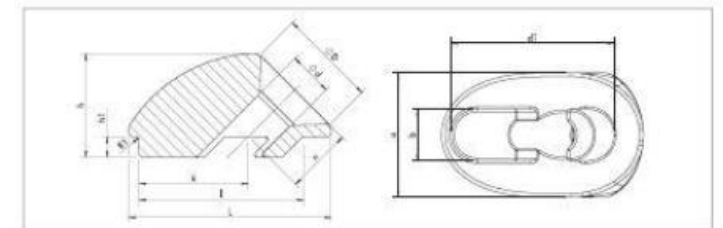
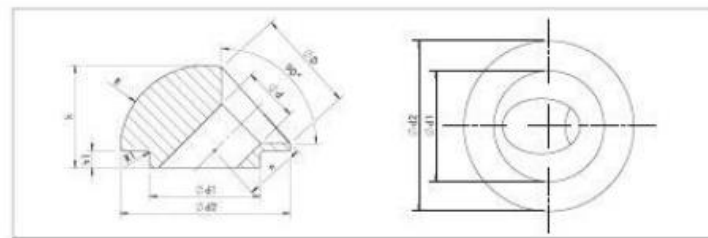
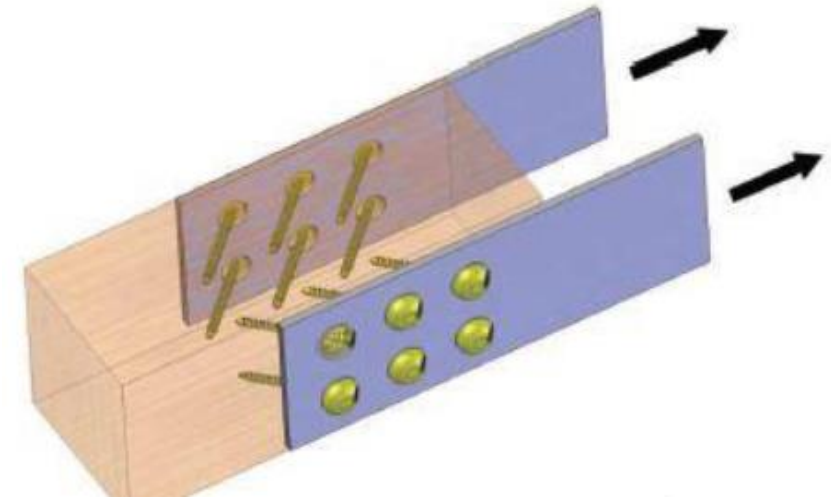
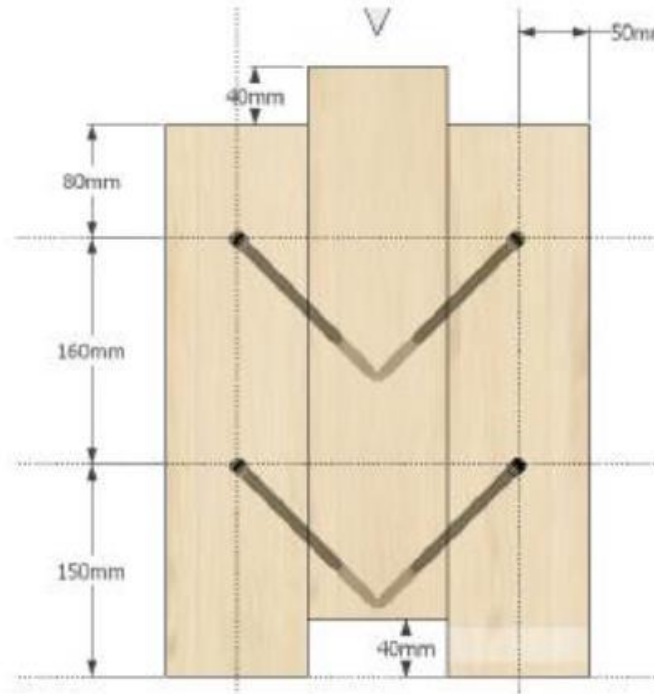
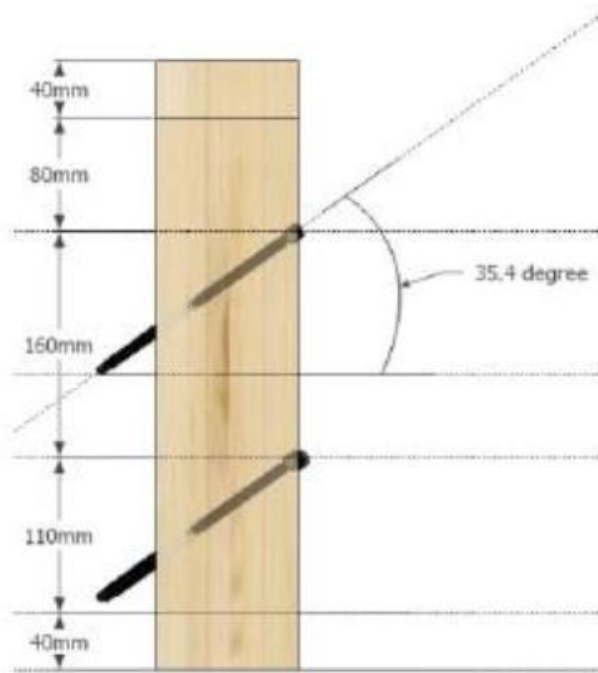
Disadvantages of glued-in steel rods in timber:

1. Connections are sensitive to the moisture content change;
2. The installation process is hard to control.



Main structural types of high-rise timber buildings (Frame system)

Screws installed at an angle of 45 degrees 1

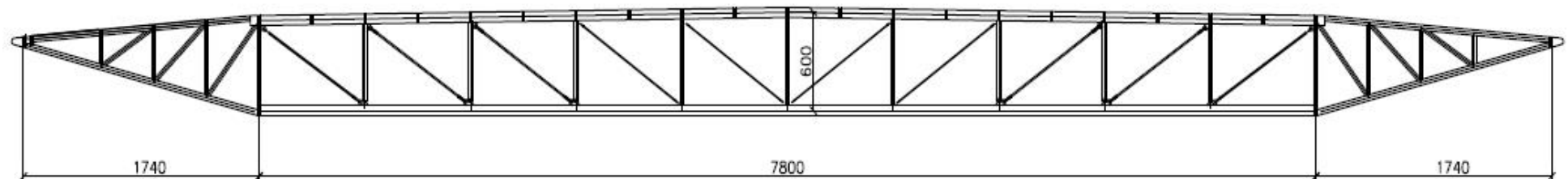


Main structural types of high-rise timber buildings (Frame system)

Screws installed at an angle of 45 degrees 2



30m high
77m free span + 12m cantilevers
12 x 115m long truss, 6.7m high
2,600 m³ glulam beams



Source: Wiehag

Main structural types of high-rise timber buildings (Frame system)

Screws installed at an angle of 45 degrees 3



Photo: Atlas Copco

Main structural types of high-rise timber buildings (Frame system) Screws installed at an angle of 45 degrees 4



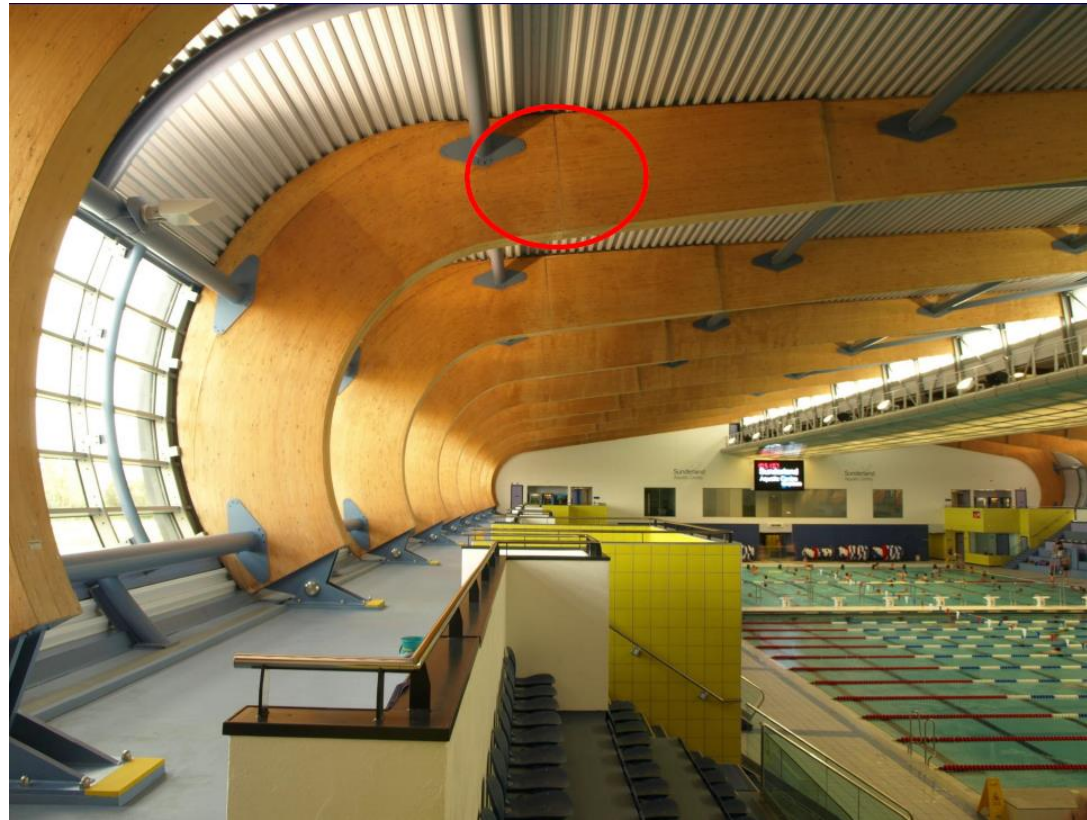
Main structural types of high-rise timber buildings (Frame system)

Screws installed at an angle of 45 degrees 5

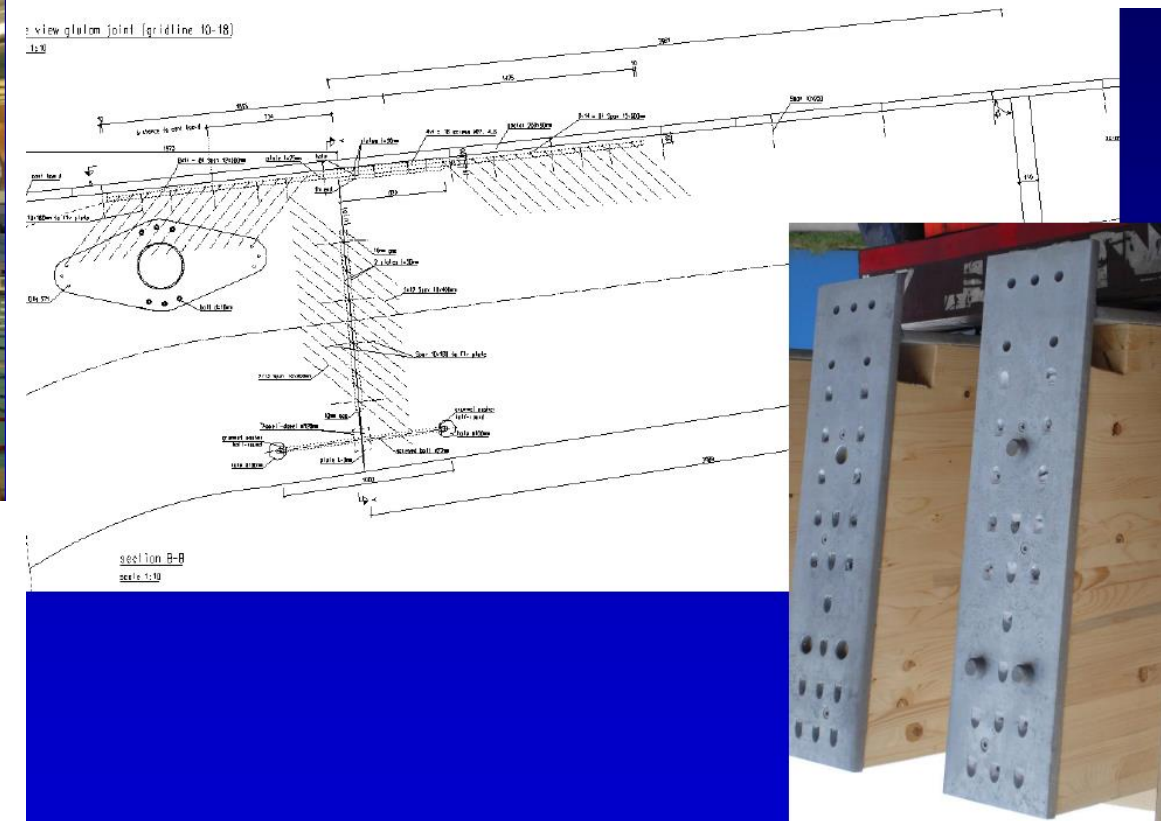


Main structural types of high-rise timber buildings (Frame system)

Screws installed at an angle of 45 degrees 6



Sunderland Aquatic Center



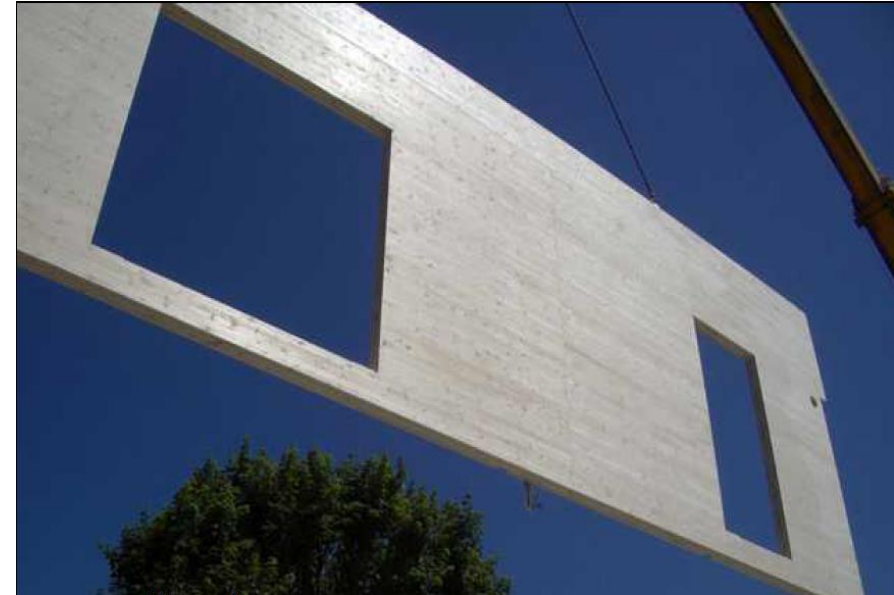
Moment resisting connection

Main structural types of high-rise timber buildings (Shear wall system) 1



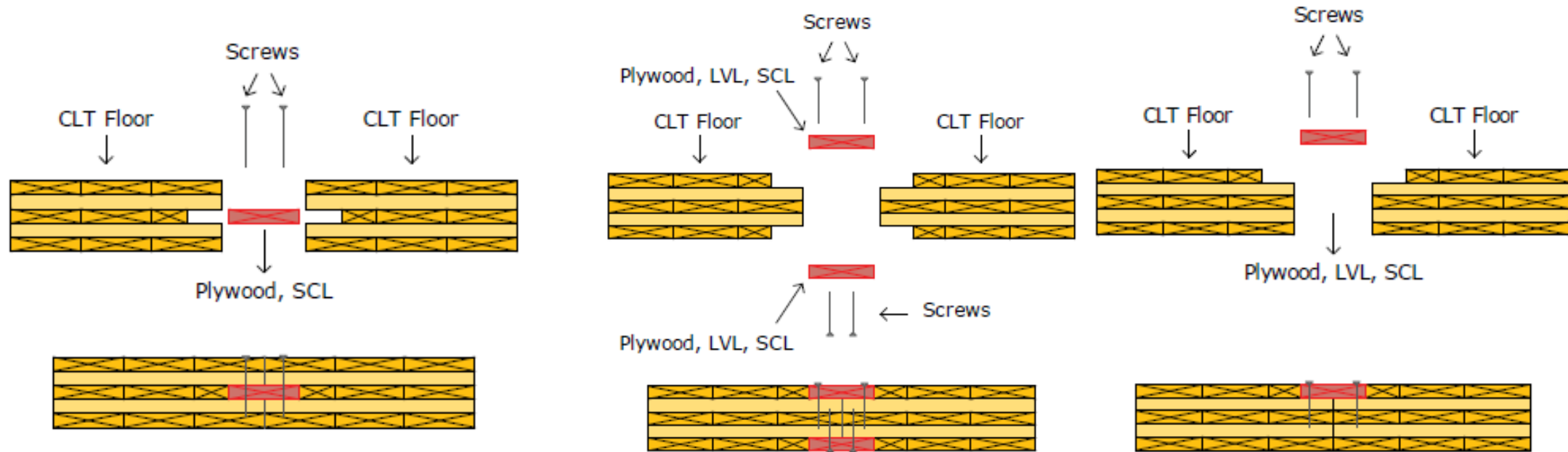
(*Gold Section Homes. Six-storey residential house in London* <http://waughthistleton.com/>)

Main structural types of high-rise timber buildings (Shear wall system) 2



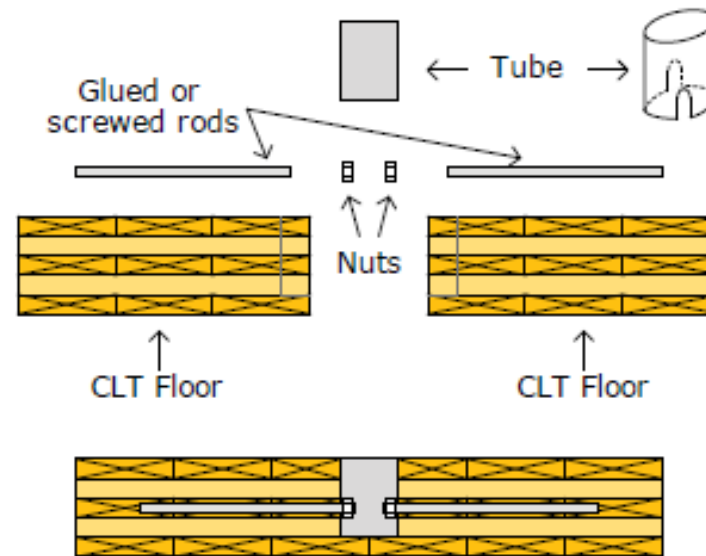
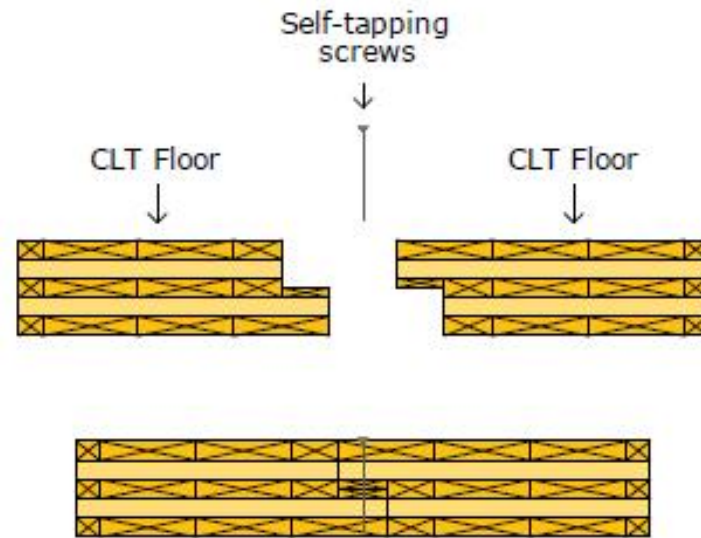
Main structural types of high-rise timber buildings (Shear wall system)

Connections 3



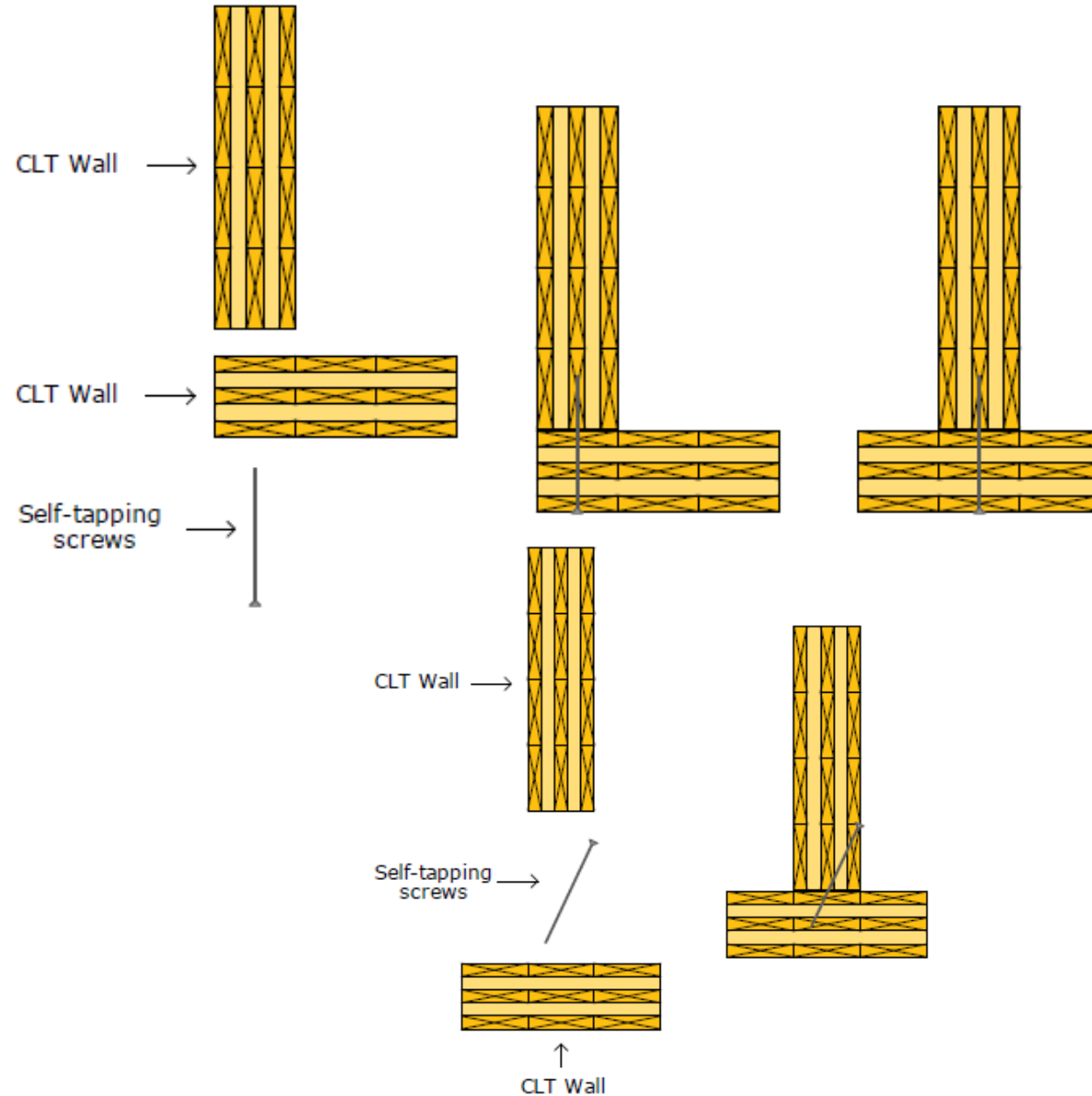
Main structural types of high-rise timber buildings (Shear wall system)

Connections 4



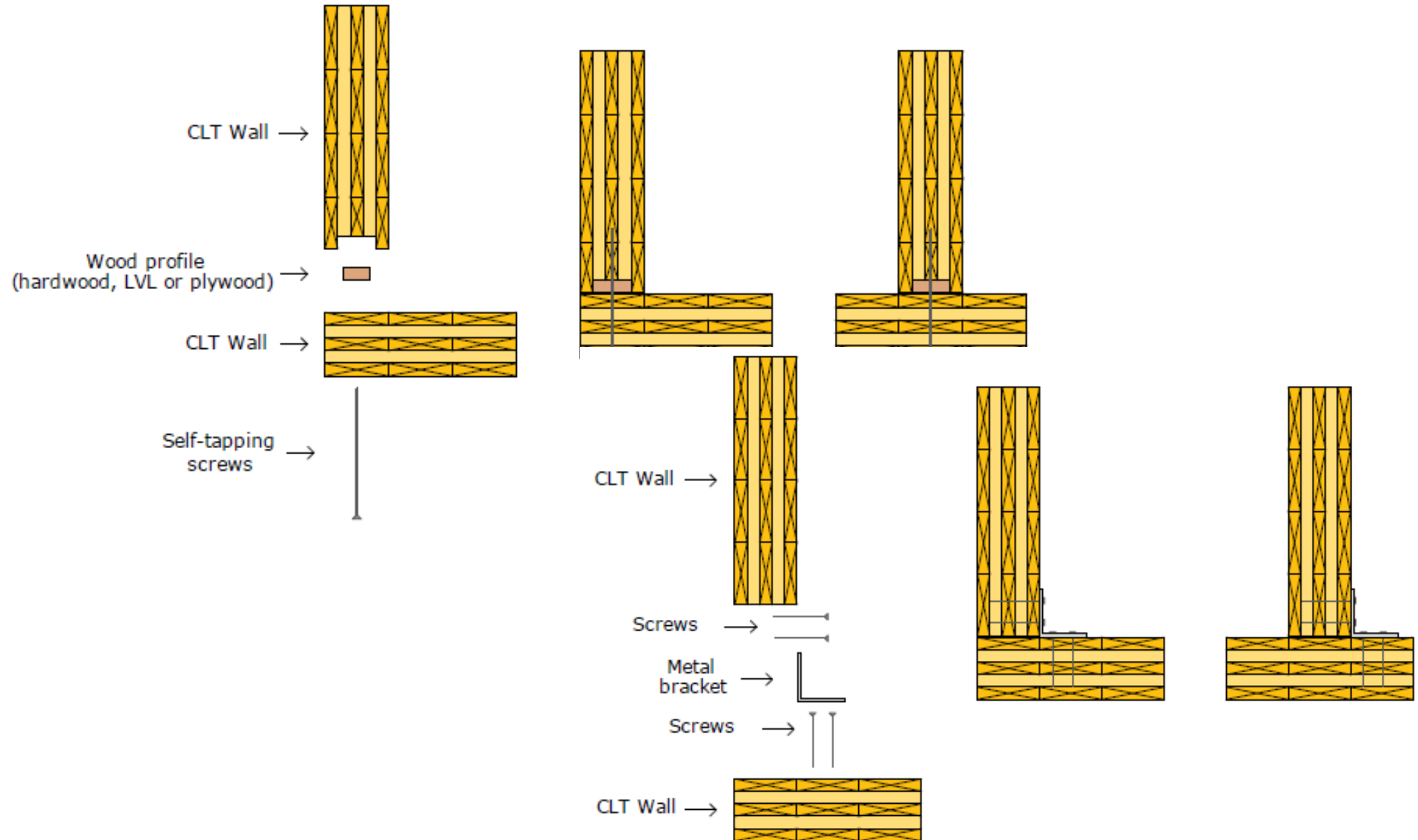
Main structural types of high-rise timber buildings (Shear wall system)

Connections 5



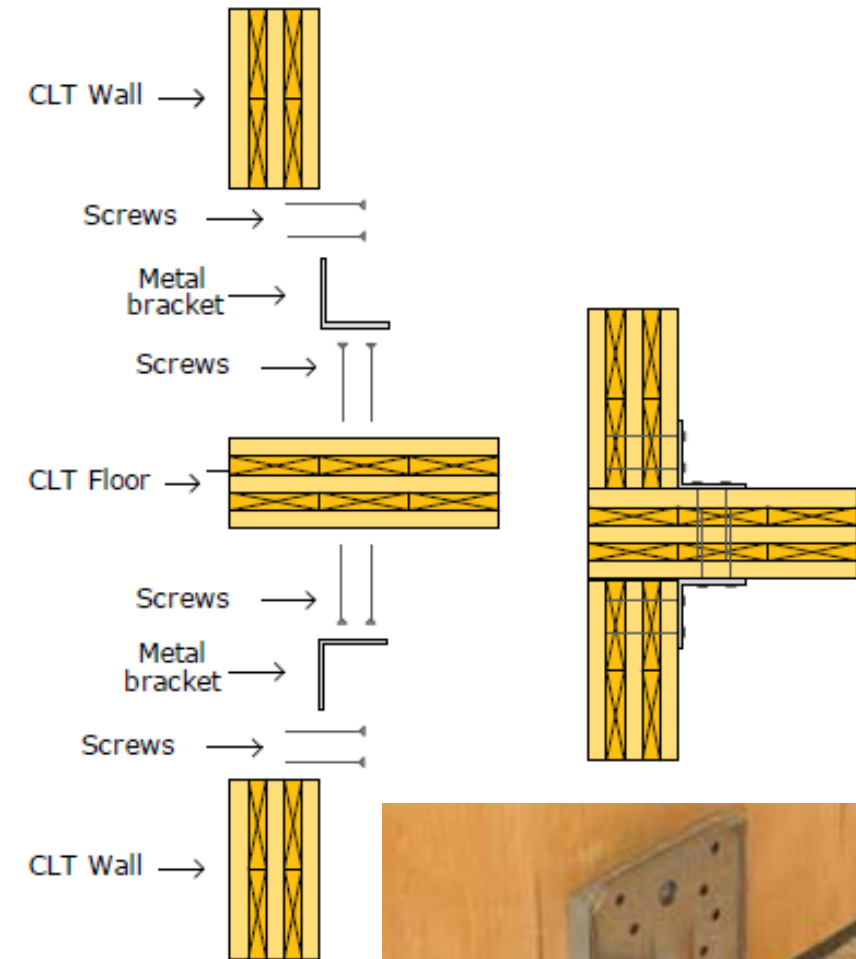
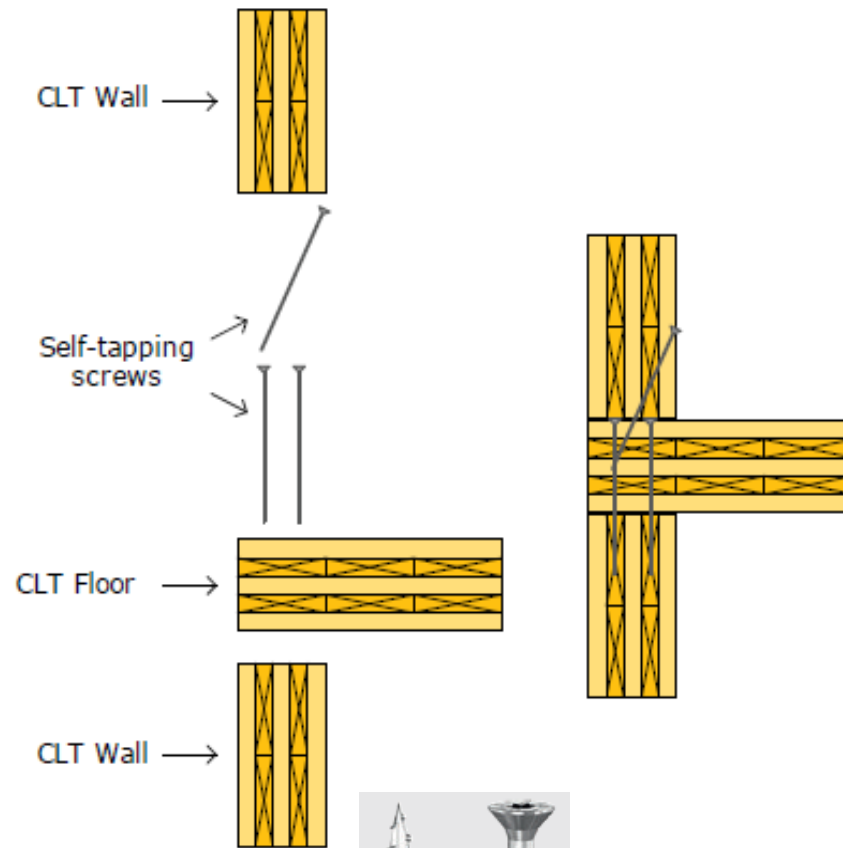
Main structural types of high-rise timber buildings (Shear wall system)

Connections 6



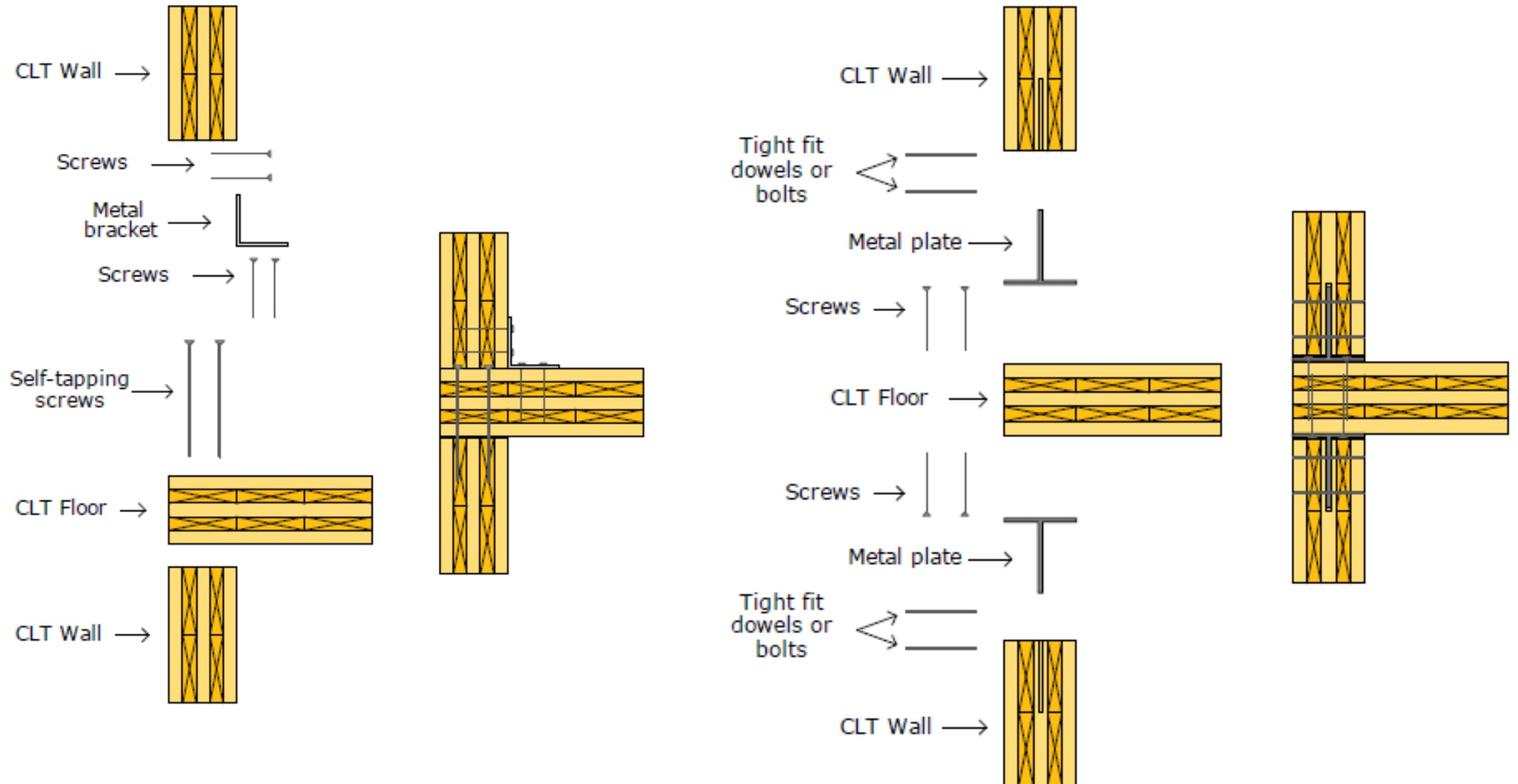
Main structural types of high-rise timber buildings (Shear wall system)

Connections 7



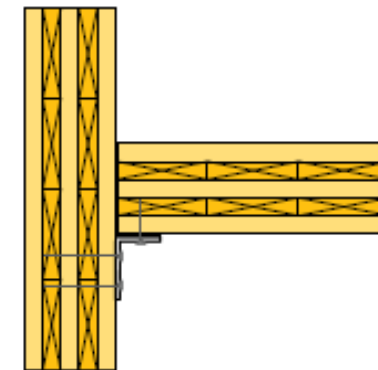
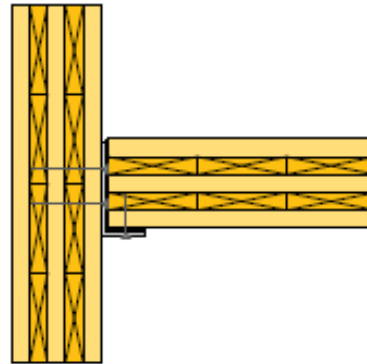
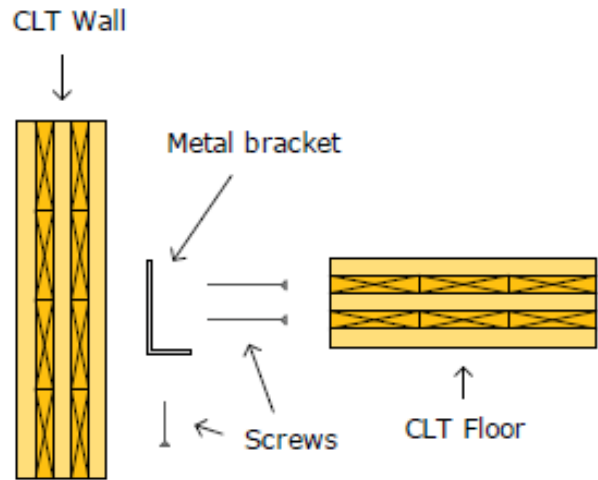
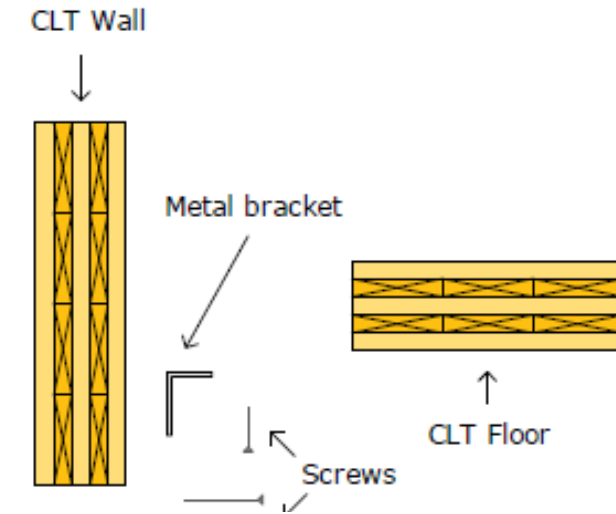
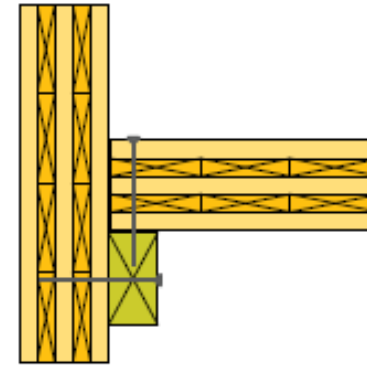
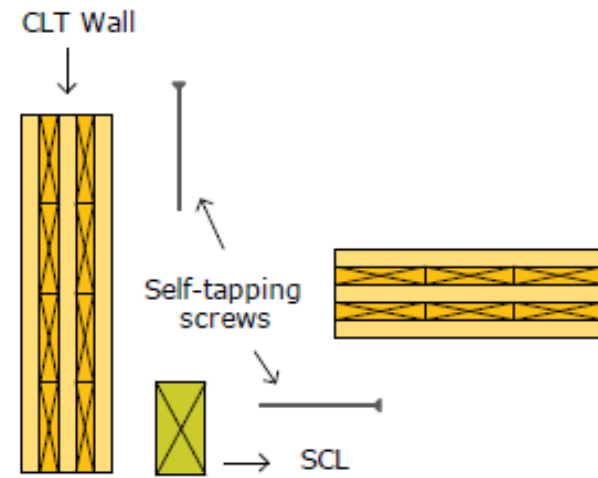
Main structural types of high-rise timber buildings (Shear wall system)

Connections 8



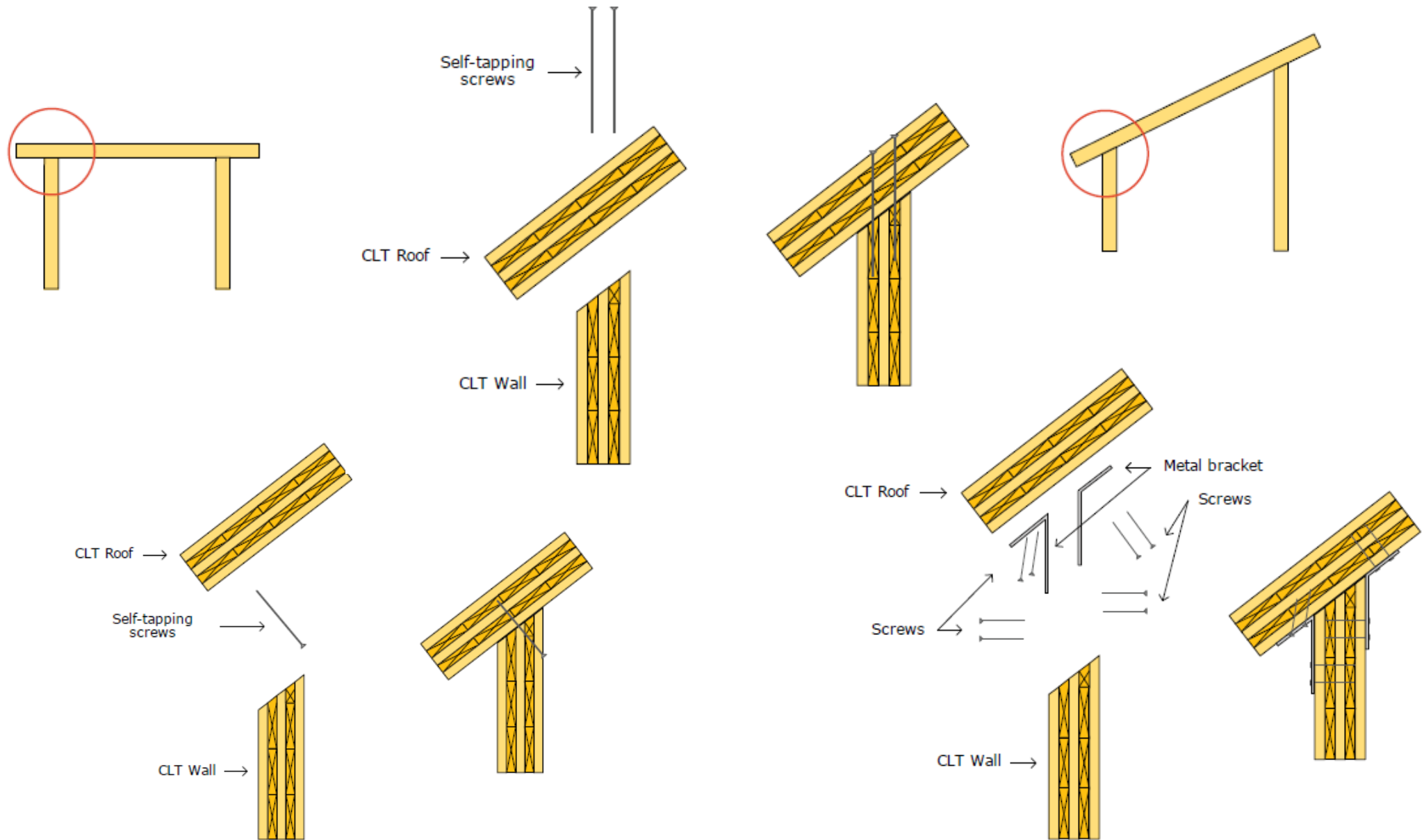
Main structural types of high-rise timber buildings (Shear wall system)

Connections 9



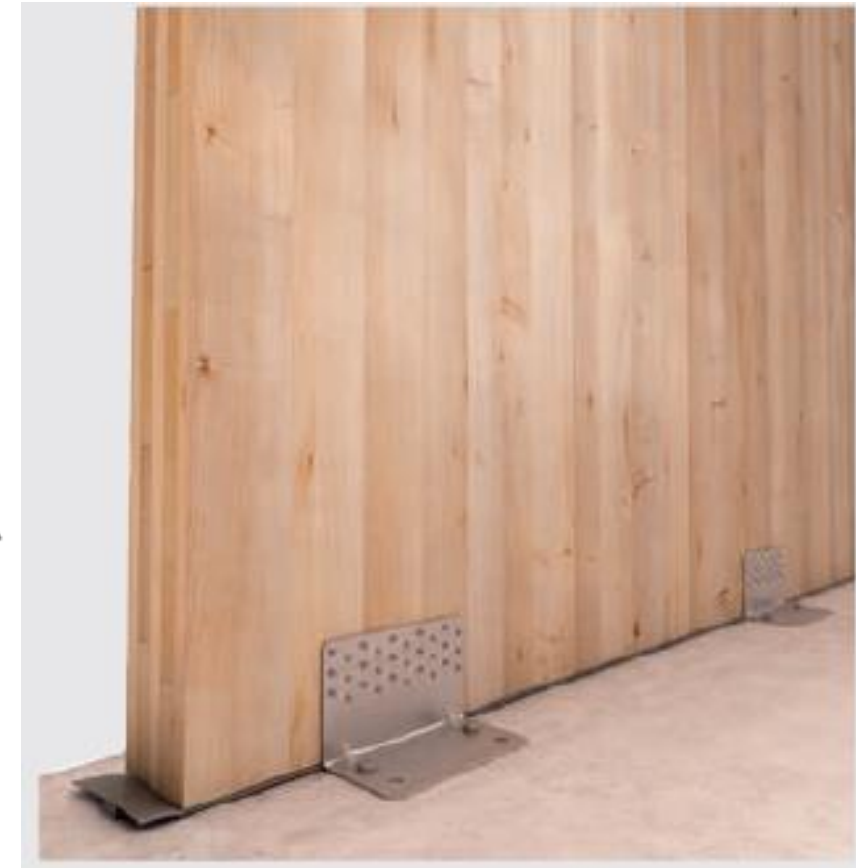
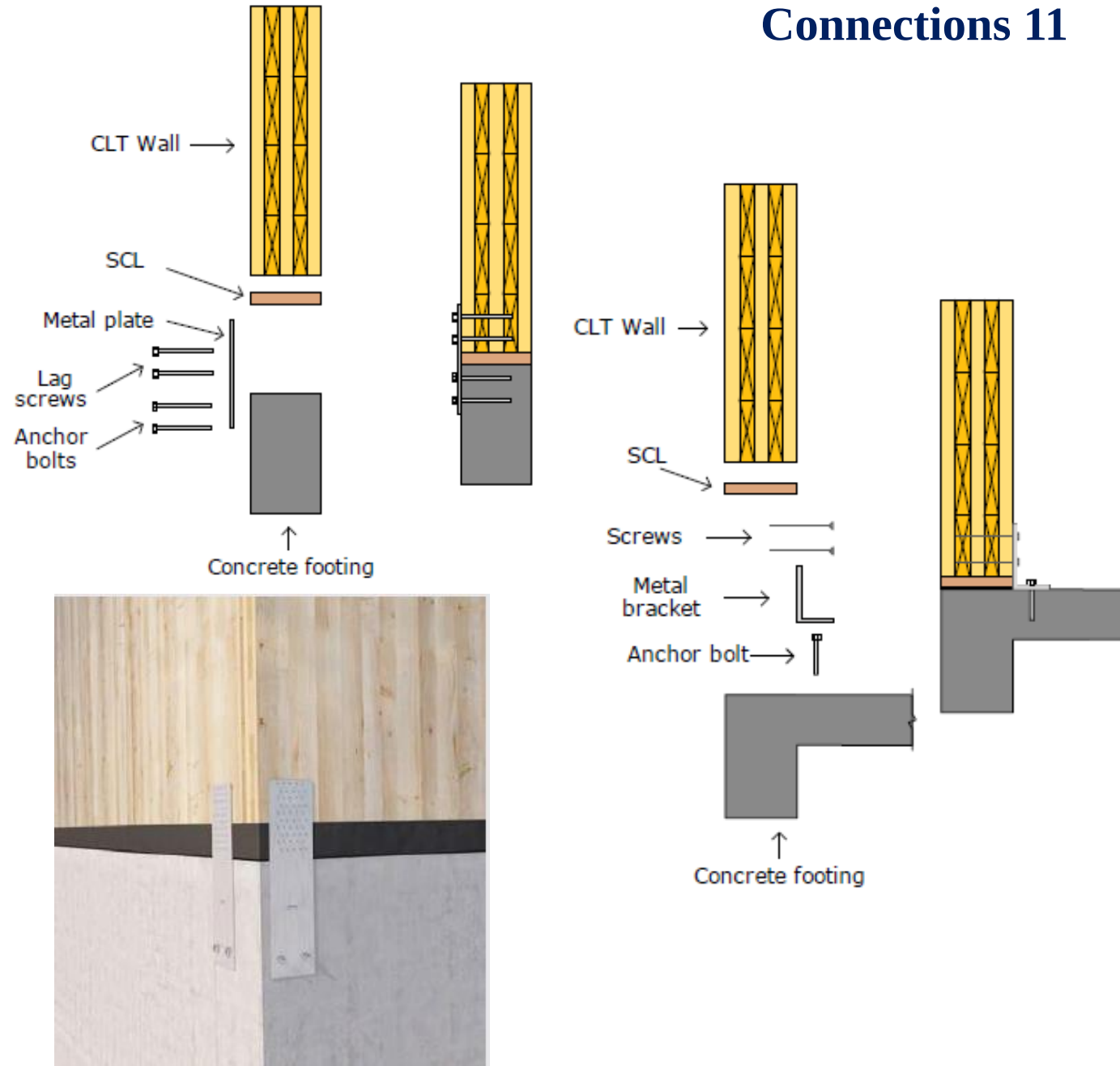
Main structural types of high-rise timber buildings (Shear wall system)

Connections 10



Main structural types of high-rise timber buildings (Shear wall system)

Connections 11





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