



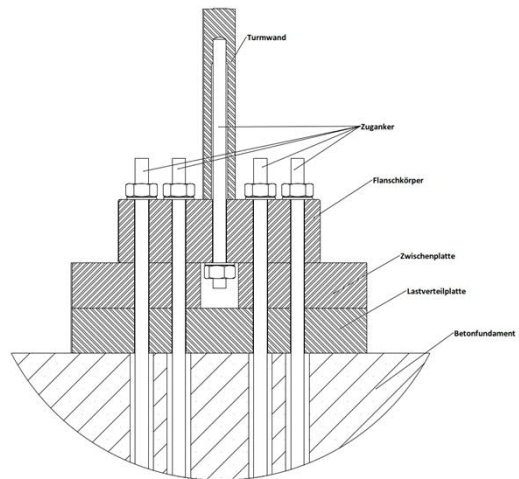
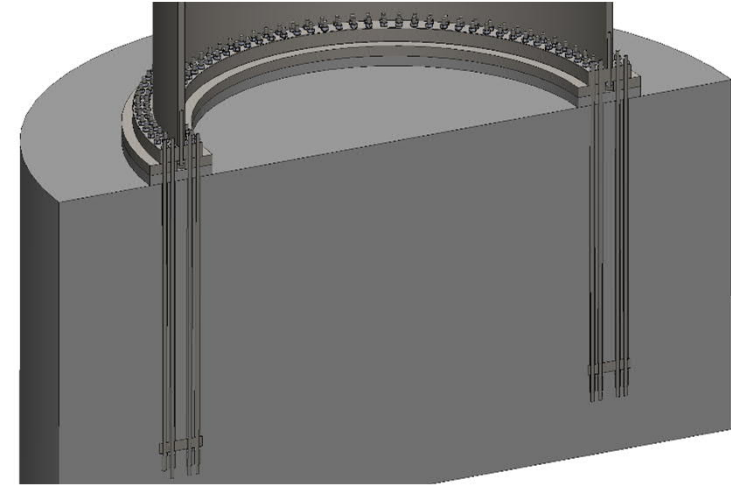
## Double bolt flange with/without bolted flange plate

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# CONCEPT

# (1) Double bolt - (2) Bolted flange plate

Double bolted T-Flange for foundation anchor bolts

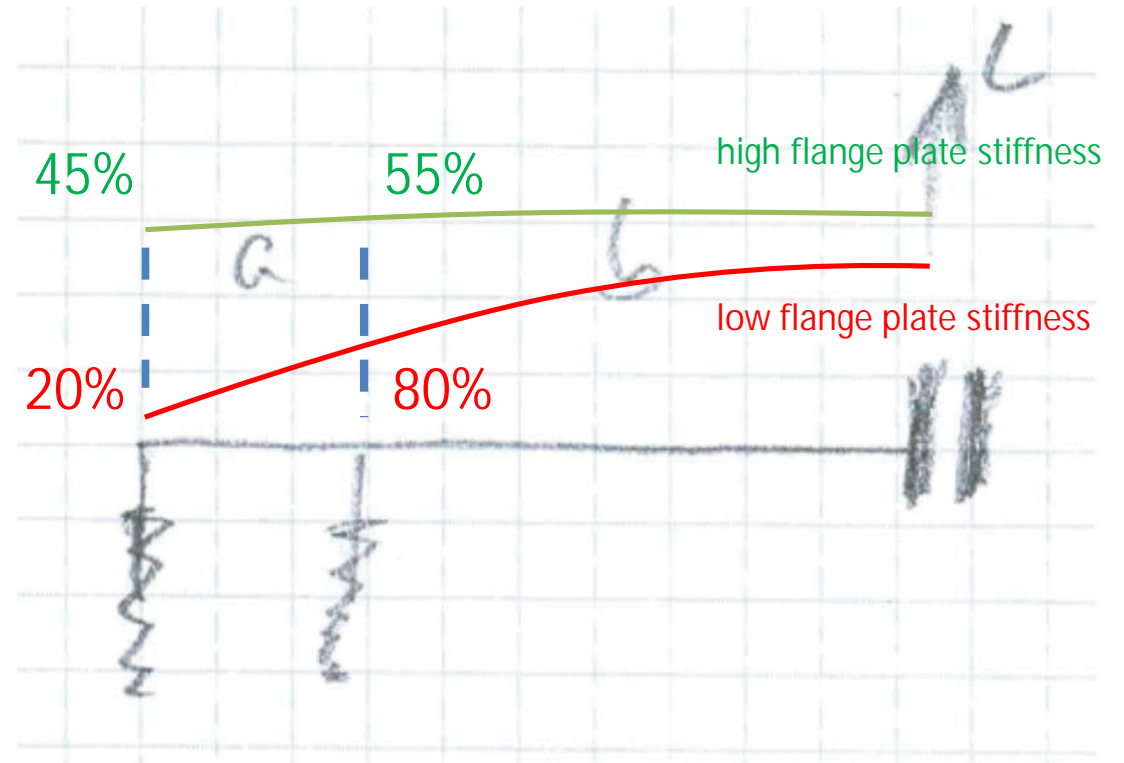


The T-flange is bolted to the shell wall thickness.

# DOUBLE BOLT

# Double bolt works on T-Flanges, because

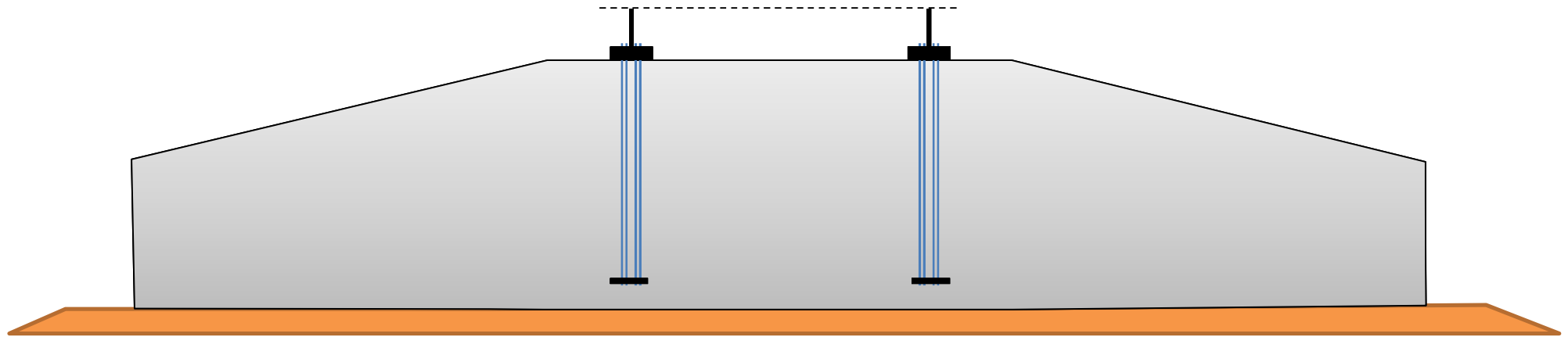
- » Only T-Flanges
- » Only for low stiffness of bolts compared to flange plate as usually given for foundation anchor bolts
- » Not possible to achieve 50/50 force distribution
- » Realistic achievable 55% (1.82) to 60% (1.6)



Increase of capacity in magnitude of 1.6 to 1.82

## Foundation anchor bolts

Low stiffness of foundation anchors bolts are especially provided where the bolts are anchored near the bottom of the foundation. This is also beneficial for general FLS behaviour of the bolts.



## Concepts for use

Double bolted T-flanges may be used for cost optimisation:

- » 2x M36 ( $1.8 \times 580 \text{kN} = 1040 \text{kN}$ ) cheaper than 1x M48 (1060kN)?
- » 2x M48 ( $1.6 \times 1060 \text{kN} = 1696 \text{kN}$ ) cheaper than 1x M56 (1460kN)?
- » 2.2x M48 ( $1.1 \times 1.6 \times 1060 \text{kN} = 1865 \text{kN}$ ) cheaper than 1x M64 (1926kN)?

or in case allowing smaller diameters:

- » Higher capacity of bottom flange at the same diameter
- » Bottom flange to foundation is often limited by the larger bolt distances from concrete

## Potential use

Using smaller foundation anchors for lower working efforts and procurement with the cost of multiple handling. It requires large foundation anchor.

Allowing higher foundation flange capacity at key diameter of transportation.

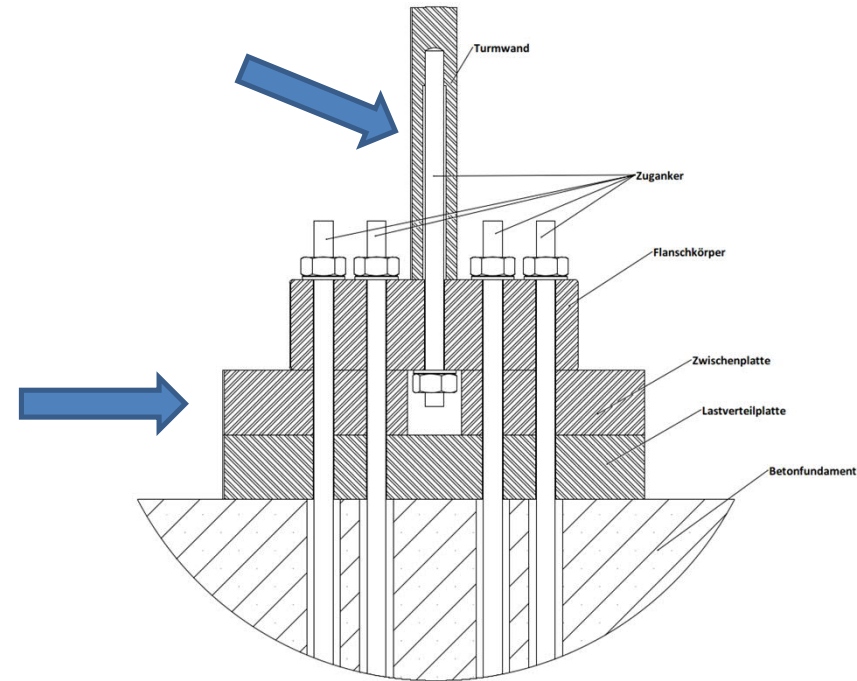


# BOLTED FLANGE PLATE

# Concept

Bolted in large depth to increase effective bolt length

Compensation plate to accommodate bolt nut



for both single and double bolted T-Flanges

## Reasons for this solution

- » Increase of effective diameter in case of transport limitations
- » Converting flange plate from forged and machined part to regular plate cutted part

## Open aspects to be discussed

- » Determined detailed FLS behaviour and capacity
- » Securing bolt by e.g. Nordlock to increase acceptance for covered bolt
- » Determined wall thickness of the shell including e.g. local bending moment



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