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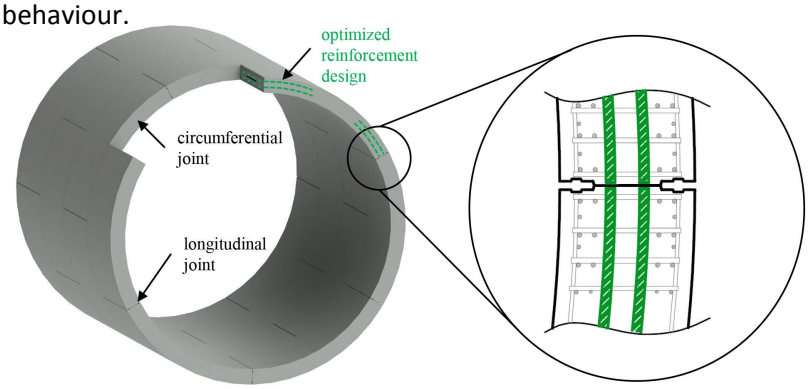
Novel Reinforced Tubbings with Enhanced Load-Bearing Capacity

The presented invention describes a new method for the construction of a longitudinal joint between two tubbings. The optimised reinforcement design provides higher load-bearing capacity than the designs currently used in modern tunnel construction.
Tubbings are segments of reinforced concrete sequentially assembled in a tubbing ring with circumferential joints to create a shield structure for a tunnel or a shaft.

BACKGROUND

Tunnels are often built using the segmental tunnel lining method. In this construction method, the tunnel tube is formed by tubbing rings, arranged one after another. Each tubbing ring consists of, e.g. six to ten, individual tubbings, which are prefabricated from reinforced concrete near the construction site. The so-called longitudinal joint is located between the individual tubbings of a tubbing ring and is usually the weakest area of the tubbing ring and decisive for the determination of the thickness of the tubbings, which is generally constant for the whole tunnel. By optimizing the reinforcement in this joint (as shown in the graphic below), the load-bearing capacity of the tubbing ring is increased.

The thickness of tunnel structure is generally consistent along the longitudinal axis, and is therefore calculated for maximum radial pressure forces. In building practice, the compressive forces from the surrounding rock or soil material vary in magnitude. Special steel tubbings are often used for sections exposed to high compressive forces. However, tubbings made of steel are considerably more expensive than tubbings made of reinforced concrete. Therefore, numerous proposals have been made in the past to increase the compressive force that can be absorbed in a longitudinal joint between two reinforced concrete segments. However, the proposed methods show disadvantages in regards to manufacturing costs, corrosion, and fire behaviour.



Schematic: Segmental tunnel lining structure (left), detail of the optimized reinforcement design in the longitudinal joint (right)

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In the terminal areas of the tubbings steel bars are connected to the reinforcement, which are oriented parallel to the direction of the compressive load of the installed tubbings. By directly transferring the pressure to these reinforcement bars, the tubbing can be made even thinner while retaining the same load-bearing capacity.

ADVANTAGES

The advantage of an individual tubbing is found to be particularly evident when several of these tubbings are assembled to form a segment ring:

- Higher load-bearing capacity at same tubbing thickness
- Material-saving, cost efficient technique
- No disadvantages due to fire resistance or durability, e.g. corrosion

REFERENCE:
M008/2019

APPLICATIONS:
Tunnels, shafts

KEYWORDS:

- Tubbing
- Longitudinal joint
- Butt joint
- Tunnel construction
- Segmental tunnel lining

IPR:
Patents pending

OPTIONS:

- R&D collaboration
- License agreement
- Sale

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