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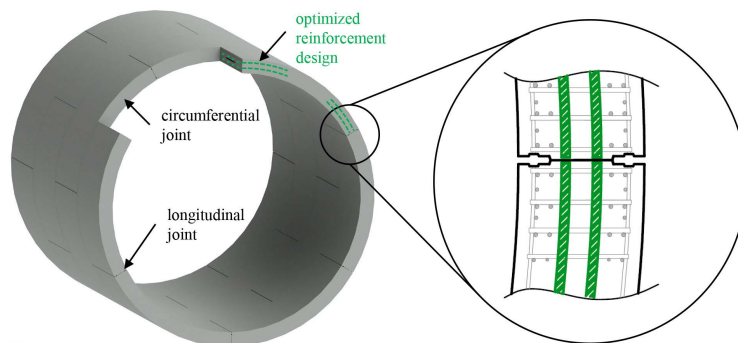
Novel Reinforced Tubblings with Enhanced Load-Bearing Capacity

The presented invention describes a new method for the construction of a longitudinal joint between two tubblings. The optimised reinforcement design provides higher load-bearing capacity than the designs currently used in modern tunnel construction.

Tubblings are segments of reinforced concrete sequentially assembled in a tubbling 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 tubbling rings, arranged one after another. Each tubbling ring consists of, e.g. six to ten, individual tubblings, which are prefabricated from reinforced concrete near the construction site. The so-called longitudinal joint is located between the individual tubblings of a tubbling ring and is usually the weakest area of the tubbling ring and decisive for the determination of the thickness of the tubblings, 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 tubbling ring is increased.



Left: Segmental tunnel lining structure.

Right: Detail of the optimized reinforcement design in the longitudinal joint.

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 tubblings are often used for sections exposed to high compressive forces. However, tubblings made of steel are considerably more expensive than tubblings 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.

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

ADVANTAGES

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

- Higher load-bearing capacity at same tubbling 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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