Pantex Lattice Girders
System Description Pantex Lattice Girders

Field of application

Pantex Lattice Girders have been developed for the special demands in the field of tunneling. The Pantex System has been extensively tested and successfully used for numerous tunnel projects throughout the world. Contrary to standard steel sections (solid-web girders, irrespective of the shape), Pantex Lattice Girders are entirely integrated in the shotcrete lining.

Thereby, the reinforced lining forms a homogeneous composite structure without unconsolidated areas. Porous zones and shotcrete spray shadows can be avoided. The overall result is a tunnel lining that significantly reduces ground deformations and prevents the ingress of water.

Pantex Lattice Girders ensure an immediate support in the excavation area. The load-bearing characteristics of Pantex Lattice Girders have been proven in terms of testing procedures, examining the significant static load conditions. These experiments have confirmed the stability and high load-bearing capacity even when not bonded into the shotcrete layer. This is an important criterion for immediate ground support, particularly during the curing time of the shotcrete.

Integral part of the shotcrete lining reinforcement

Pantex Lattice Girders exhibit an excellent interconnection with the shotcrete layer. The quality of the bond between the shotcrete and the Pantex Lattice Girders is essentially determined by the mechanical properties of the shotcrete (compressive and tensile strength) and the lattice girder geometry. The excellent interlocking of Pantex Lattice Girders with the shotcrete has been determined by several pull-out tests in terms of characteristic curves. These consolidated findings allow to include the Pantex Lattice Girders into the design of the shotcrete layer according to the reinforced concrete concept.
Specifications Pantex Lattice Girders

Bars, Stiffeners

All load-bearing elements are produced according to the particular demands in tunneling:

- High strength
- Great deformability
- Well suited for welding
- Steel grade: Reinforcing or construction steel BSt 500 according to DIN 488-1

Connections

- **Flat steel** or **angle steel** St 37-2 or St 52-3 according to DIN 17100, depending on the girder type
- **Bolts** are provided in matched quality (e.g. 8.8 according to DIN 267-3)

Quality Control

All quality features are defined according to the theory of quality control as 5%-quantile of the basic population considering a statistical probability of W = 0.9. Materials and manufacturing of Pantex Lattice Girders (particularly the welding work) are continuously controlled both by self-monitoring and external quality control.

Experiments concerning the load-bearing capacity of lattice girders. Institute for Material Testing, Bureau for Civil Engineering, Technical University Munich.
Main advantages for the use of Pantex Lattice Girders

- Immediate support in the excavation area
- Utilization as a template when applying shotcrete
- Easy and quick assembling, simple handling
- Optimum bond and interconnection with the shotcrete lining
- Simple adjustment and shaping to the excavation geometry
- Optimum bearing for spiles and lagging boards
- Spiles can be installed both above or through Pantex Lattice Girders
Three bars, aligned with stiffeners, are assembled to form a girder. Thereby, the single bar can, depending on the requirements, either be arranged on the inner or outer side relative to the curvature fitting the specific excavation geometry. The stiffeners (also known as “spiders”) reduce the local buckling lengths of the bars and provide, besides a high normal and bending moment resistance, an assured transfer of the normal forces even before the shotcrete has been applied.

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1) Cross-sectional area of the bars
Pantex Lattice Girders / 4 Bars

Four bars, aligned with stiffeners, are assembled to form a girder. Due to the design of the 4-bar girder, an adjustment to fit the specific excavation geometry can easily be accomplished. The stiffeners reduce the local buckling lengths of the bars and provide, besides a high normal and bending moment resistance, an assured transfer of the normal forces even before the shotcrete has been applied.

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\(^1\) Cross-sectional area of the bars
Pantex Lattice Girders / Wallplate Beams

4-bar-girders are also used as longitudinal wall plates for heading advances. They serve as bearing and template for the arch assembly. At the same time, they can be considered as statically effective reinforcement for the base beams. The frontal connection is bending resistant.

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