

Use Case 14: Prefabrication and manufacturing

Purpose

Each tunnel project has specific tunnel lining requirements, depending on the diameter, the soil conditions and the alignment, so that a safe and durable tunnel structure can be produced.

The production of pre-cast elements requires very high precision. Important parameters like the tunnel alignment with its straight sections and vertical and horizontal curves, static compliance, as-excavated profiles (tunnel overburden, over/under-excavation) etc. must be observed already when designing the rings and segments.

The just-in-time supply of segments is an important prerequisite for non-stop tunnelling operations.

After installation in the tunnel, they have to withstand demanding use for its designed lifetime.

During the design phase, the experts have to consider not only the forces/loads and the geo-mechanical stresses in the ground, but also the loads during production, storage, transportation, logistic handling and installation of precast elements. These are, for example, ongoing vibration processes and heat requirements, taking into account the hydration while the concrete for the segments is setting. This kind of input information does not necessarily have to be transported by IFC, but the resulting detailed design information.



Source : <https://www.stradal-vrd.fr/content/infrastructures-souterraines-et-tunnels>

This use case refers to the partially automatized construction of the segments and especially about specific or particular segments as reinforcement segments with fire protection, or specific reservations in the segments for bypasses.

The IFC exchange scenario to be covered is:

- from (detailed) design software to segment/accessories manufacturer applications and machine steering software
- from manufacturer/on-field application to as-built/asset management application

Requirements for IFC-Tunnel:

- Ring/segment geometry
- Information related to design
- Information related to logistics
- Information related to status/control

Geometry:

The geometry of prefabricated elements, such as rings and individual segments, as well as the arrangement of the joints, jackets and their sealing must be considered, as well as the geometry related to logistic handling equipments. Reinforcement in 3D should be documented as well. Type of geometries to be supported are solid elements, with precision more than millimetric. In addition, tolerances play a very important role and must be described appropriately.

This includes also the precise as-installed location of the precast elements, so integration with BIM for Infrastructure solutions should be considered appropriately.

Semantics:

All existing entities must be described with appropriate semantics and identification means (eg, segments' RFID). In addition, specific characteristics must be documented, such as materials, load conditions, logistics, storage conditions, installation tolerances, etc. Waterproofing elements need to be described in the appropriate details level.

Links with other UCs:

Input use cases:

- UC 3 – Exchange of alignment and major roadrailway parameters (to be harmonized)
- UC 7 – Structural & geomechanical analysis (in construction design, detailed segment/ring design include also precise geometry)
- UC 9 – Standards compliance (to be harmonized)

Output use cases:

- UC 10a – Quantity take-off (Mechanized)
- UC 11 – Construction sequencing (4D modelling)
- UC 15a – Progress monitoring
- UC 15d – Quantity determination for billing / payment
- UC 16 – Machine guidance & control
- UC 17 – Damages recording