Netherlands Knowledge Centre for Underground Space and Underground Construction

Proposal 4

Title: The real life expectancy of tunnels; how to get a complete picture

Theme: Repair and maintenance of underground structures
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Abstract:
Worldwide, renovation of tunnels is becoming a huge challenge. Due to the large costs and the need for accessible infrastructure, choices need to be made as to which tunnels will be renovated first or how to divide the renovation in affordable and practical parts, which renovations can be postponed and what should be the scope.

Whilst a range of asset management strategies have been developed for road and rail infrastructure, the application of these approaches to for tunnels is limited because of lack of data;

a. From a structural perspective there is uncertainty in assessing the residual life span of the structure due to a lack of information on aging behaviour for joints, transitions and foundations..
b. The relationship between changes in physical environment of the tunnel (soil, groundwater, changing river depths and widths, construction other structures) and the expected residual life span.
c. Traffic loading is evolving and in conjunction with innovations in vehicle types this provides a further challenge in assessing future loading conditions in tunnels.

In this paper we consider the impacts of these effects on tunnels in soft soils because we expect the failure mechanisms and the uncertainties to be the highest for these tunnels and they are the most relevant to Delta-areas. We do expect a difference in failure mechanisms between different kinds of construction types, so we will look at bored, immersed as well as in-situ tunnels in that regard. We limit ourselves for the time being to road- and railway tunnels but we do expect the results to be applicable to other types of structures.

In general, tunnels can be subdivided in large sub-systems such as Logic Function Fillers (LFVs) (i.e. the most important mechanical engineering components, such as tunnel ventilation), Operation, Controlling and Monitoring Components (i.e. the mainly electro-technical components that provide the control of the LFVs), Local Operation Components (i.e. the electrical and ICT components that interface with the operator), Road and Pavement Construction and Civil Construction (i.e. the tunnel tube and the tunnel channel). **In the scope of this study, we focus on the Civil Construction.**

We aim to make a decomposition of a Civil Construction of a tunnel and its surroundings that might influence the residual life of the structure, the of failure-mechanisms that might occur (and why), the kind of mitigation and control mechanism we have and how much we know of the effectiveness of these measures. We also expect to identify failure mechanisms without proper control mechanisms Here their likelihood times consequences will give us a scope to search for new solutions.

With this bigger picture and common goal we hope to really take a leap towards predictable asset management, a higher availability of our network and a well-used investment of (mostly) public money.