

# **GCP Preprufe® Plus**

## **Summary of third party report from**

### **STUVATEC Institute – Köln (DE)**

**Pre-applied bonded  
membranes vs. watertight  
concrete (“white tank”)**



**April 2017**

# Pre-applied waterproofing membranes: Comparison vs. Watertight Concrete System



## Key findings

- Pre-applied fully bonded membranes provide **several advantages vs. watertight concrete.**
- They solve the issue of cracks that could appear even in watertight concrete structures, and provide **an effective protection of the structure** from water, vapour diffusion, aggressive soils, etc.
- Pre-applied membranes can be **used as the sole waterproofing layer** without the waterproofing concrete construction acting as a second, inner and redundant waterproofing layer.
- The pre-applied membrane should be **considered as primary barrier** and not as a supporting (secondary) one in combination with a white tank system.
- The **crack bridging capability** of these membranes also allows a more efficient use of steel reinforcement, reducing the costs for reinforcing steel by up to 40%.

“Overall, it is stated that the development of the pre-applied fully bonded membrane technology has contributed to **considerable advantages and cost benefits** in the construction and waterproofing of reinforced concrete structures exposed to groundwater, seepage water and soil moisture.”

# Pre-applied waterproofing membranes: Comparison vs. White Tank System



Differentiation aspects	Pre-applied fully bonded membranes	Watertight concrete (white tank)
<b>1. Waterproofing concept</b>	Pre-applied fully bonded membranes are an external waterproofing system using a single layer of membranes. No waterproofing concrete construction is needed as a second, inner and redundant waterproofing layer.	A waterproofing concrete construction is watertight in itself and does not need any external waterproofing membrane but several additional components like waterstops and crack-limiting reinforcement.
<b>2. Point of time the effective water tightness begins</b>	A pre-applied fully bonded membrane system is immediately and directly in contact with seepage or pressurized water in the ground (if there is any water at all). It fulfills the waterproofing function primarily. The concrete behind it only serves as a static support to the membrane against water pressure. The concrete structure is only wetted by water, if the pre-applied fully bonded membrane fails locally. But, due to the continuous bond inherent to the system of the pre-applied fully bonded membrane, the area of leakage is very restricted and, in case, easy to fix.	A watertight concrete structure (white tank) inevitably tends to form cracks. These cracks have to be grouted where they are not self-healing. Such a self-healing process is limited to small crack widths and needs time. During this time the construction will leak temporarily. To avoid such major leaking additional reinforcement is needed, thus reducing crack widths and optimizing the distribution of cracks. In case of a lower groundwater table higher located water-bearing cracks cannot be recognized. For such initially dry cracks the self-healing process will not start before the area becomes wet.
<b>3. Crack control</b>	Pre-applied membranes show a capability of bridging cracks up to a crack width of at least 0.4 mm. No crack-limiting additional reinforcement is needed, reducing the cost of that by 20% to 40% compared to traditional watertight concrete.	The effectiveness of watertight concrete (white tank) is based on crack control. In order to distribute the cracks better and to limit their opening widths an extra amount of steel is needed depending on the thickness of the construction element, the diameter of the reinforcement bars used and the calculated design crack width. Compared to the reinforcement that is necessary anyway for structural reasons, this can cause additional costs.
<b>4. Protection against water and aggressive soil</b>	Pre-applied fully bonded membranes protect the supporting concrete structure, especially in case of contaminated water or aggressive soils. Even in the special case where a double waterproofing system is chosen, the bonded system provides the real first barrier with a sealing effect that is independent of the selected concrete grade.	In case of ground aggressive to concrete, the waterproofing concrete needs to be formulated according to the appropriate grade of resistance against all the contaminants in soil and water, thus possibly causing additional costs.

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# The Institutes and Professors

Studiengesellschaft für unterirdische Verkehrsanlagen mbH (Research Association for Underground Transportation)



Prof. Alfred Haack

Inseparably linked with STUVA, Professor Haack began working for STUVA in 1967, became a director in 1977 and was a Managing Director from 1995 to 2007



All around the globe, people are still asking for him to apply the knowledge he has accumulated over decades. These days, Alfred Haack is more likely to be found disseminating his knowledge in seminars or lectures

Fields of activities include fundamental research and special analyses, focusing mainly on the areas of underground construction and railway and road transport. Owing to their wide-ranging experience and knowledge gained from many years of research work, STUVA and STUVAtec are also consulted for many object-related analyses and expert reports at home and abroad.

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