Shotcrete for Underground Support XII: Opening Comments

Herbert Klapperich
ECI SUS XII 2015
International Conference on Shotcrete for Underground Support
New Developments in Rock Engineering, TBM Tunnelling, Deep Excavation and Underground Space Technology

11 to 13 October 2015
Grand Copthorne Waterfront Hotel, Singapore

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ECI - a not for profit-foundation
founded 1962 by major US-scientific organizations

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Vernissage
"DEEP SKIN"
by Dipl.-Malerin GINA
www.gina-art.de
Germany
<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Organizers</th>
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<tbody>
<tr>
<td>1973</td>
<td>South Berwick, Maine</td>
<td>Herbert Klapperich</td>
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<tr>
<td>1977</td>
<td>Easton, Maryland</td>
<td>ECI</td>
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<td>1978</td>
<td>St. Anton, Austria</td>
<td>SUS 12 - Singapore 2015</td>
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<td>1982</td>
<td>Paipa, Columbia</td>
<td>John Sharp</td>
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<td>1990</td>
<td>Uppsala, Sweden</td>
<td>D. F. Wood, R. Morgan</td>
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<tr>
<td>1993</td>
<td>Niagara-on-the-lake, Ontario, Canada</td>
<td>H. Klapperich, R. Pöttler, J. Willocq</td>
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<td>1995</td>
<td>Telfs, Austria</td>
<td>Tarcisio B. Celestino, Harvey Parker</td>
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<td>1999</td>
<td>Campos do Jordao, Brazil</td>
<td>Koichi Ono, Rusty Morgan</td>
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<td>2002</td>
<td>Kyoto, Japan</td>
<td>Rusty Morgan, Harvey Parker</td>
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<td>2006</td>
<td>Whistler, B. C., Canada</td>
<td>Felix Amberg, Knut F. Garshol</td>
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<td>2009</td>
<td>Davos, Switzerland</td>
<td>Ming Lu, Oscar Sigl, Guojum Li</td>
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ECI Conference serie SUS

= Shotcrete for Underground Support =
PROGRAM

SHOTCRETE FOR UNDERGROUND SUPPORT VII, 1995
Engineering Foundation, New York
Wet Shotcreting System
Top-Shot
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<table>
<thead>
<tr>
<th>dry mix</th>
<th>wet mix</th>
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<tr>
<td>✉️ in caverns</td>
<td>✉️ in caverns</td>
</tr>
<tr>
<td>✉️ in tunnelling</td>
<td>✉️ in tunnelling</td>
</tr>
<tr>
<td>- in rock</td>
<td>- in rock</td>
</tr>
<tr>
<td>- in soil</td>
<td>- in soil</td>
</tr>
<tr>
<td>✉️ on surface</td>
<td>✉️ on surface</td>
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<tr>
<td>- deep excavation</td>
<td>- deep excavation</td>
</tr>
<tr>
<td>- slope surface</td>
<td>- slope surface</td>
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</table>

**research** & **application**

- significant developments in shotcrete technology
- ✉️ material science
- ✉️ design
- ✉️ new additives & admixtures
- ✉️ fibers
- ✉️ equipment
... innovations ...
continuously under development

from deep tunnels
- like crossing the alps -

to downtown underground lines
- low overburden -

NATM - ...
- ...
- ...
SEM - Sequential Excavation Method

single-shelled shotcrete lining
= as permanent lining =
Case History
Economics

- Installation of 2nd layer far behind tunnel face
- Immediate installation of 2nd layer

The same support resistance will be activated.
Safety Philosophy

- RABCEWICZ

- Stability of the tunnel is guaranteed if deformations due to the excavation process have ceased.
Water pressure

- When a drainage system is used no water pressure is acting on the lining.
Problems to be solved

- Shear stress
- Rock bolts
- Construction joints
- Girders
L.F.I. INTRODUCES SHOTAX
THE NON-TOXIC ADDITIVE
FOR SHOTCRETE
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