Laser Scanning of Railway Tunnels
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Laser scanning by
**SPACETEC GmbH**
- Scanning work
- Data treatment

Data analysis and reporting by
**VR-Track / Railway Consulting**
- Data management
- Damage analysis from scanner results
- Tunnel Condition assessment
Laser Scanning Projects in Finland

Laser Scanning projects in Finland by VR-Track Ltd and SPACETEC GmbH:

- 25 tunnels
- 29 609 m
Tunnel Scanning Technology

TS3
High Definition 3 Channel Scanner

TS2
Mobile Compact 2 Channel Scanner
Possibilities for the use of Laser Scanning

- Inventory of tunnel structures,
- Clearance analysis,
- Analysis of the tunnel structures,
- Commissioning of new structures,
- Documentation of "as built" information
Tunnel Scanning Method

- 360° viewing angle, rotation at 300 Hz
- Combination of single measurements to an image
### Three Recording Channels

<table>
<thead>
<tr>
<th>Channel</th>
<th>Description</th>
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</thead>
</table>
| **Visual Image** | - Documentation of the visible Surface and its condition  
                        - Crack Detection |
| **Thermal Image** | - Additional Information  
                          - Moisture  
                          - Water intrusion |
| **3D Recording**  | - Clearance  
                        - Detection of damages |
Visual Image is the Basic Tool
Three Recording Channels

- Documentation of the visible surface and its condition
- Crack Detection
- Water Intrusions / Moisture / Warm anomalies
Visual and Thermal Data can be Viewed in Parallel

- Cracking
- Water intrusion
- Trace heated drainage
Profile Data is Basic Tool in Clearance Analysis

Clearance problem
Clearance Analysis limits are easily configured
Example of Clearance Analysis
Special Case of Clearance Analysis

On red areas along the tunnel wall, it is not possible to install the sign according to the specifications.
Information can be analyzed also in 3D
Automatic comparison of different scannings
Tunnel Inspection Process with Special Software

Data administration
Tool for zone definition
Drawing of damages and other features
Scanner data as drawing background
Statistic evaluation
Anchoring of other documents
Print
Reporting
Checklist for planning of inspections

VR TRACK

Spacetec
Finding Database can be adopted to the Clients System

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<thead>
<tr>
<th>Name</th>
<th>Label</th>
<th>Group Name</th>
<th>Type</th>
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<th>Linetype</th>
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<th>Hatch Color</th>
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Presentation of Findings from a Railway Tunnel
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