Talking Points: Accelerating Repair & Renewal of Tunnels

This document is a quick reference guide for Bentley's tunnel solutions. It provides key messaging, industry context, proof points, and project references to help articulate why Bentley is uniquely positioned to help owner-operators, engineers, and contractors accelerate tunnel design, analysis, repair, and rehabilitation with greater insight, coordination, and efficiency.

The Problem: Aging tunnels, subsurface risks, and fragmented monitoring

- Safety risks
    - Tunnels deteriorate invisibly due to water ingress, structural stress, or ground shifts, and are high-impact and high-risk to failures.
- Subsurface uncertainty
    - Poor or missing geological records create massive risk for repair planning, retrofit strategies, or adjacent construction.
- Siloed inspections and missing history
    - Manual inspections and legacy records hinder lifecycle monitoring and predictive analytics.
- Service disruption and high intervention costs
    - Tunnel closures require enormous coordination, last-minute failures or late-phase discoveries drastically raise cost.

What's needed

- Faster, data-rich inspections to catch risks before they become failures
- Geotechnical + structural insight for targeted, confident repair decisions
- Digital workflows that accelerate rehabilitation planning, reduce rework, and coordinate teams
- Digital twins + real-time monitoring to support lifecycle renewal strategies
- Interoperable tunnel-road-rail collaboration for projects that span domains

The Solution: Bentley's digital approach to tunnel renewal

Bentley delivers a digital-first approach that helps transportation professionals modernize tunnel inspection and rehabilitation. Our tools integrate geotechnical insight, tunnel modeling, construction simulation, and asset monitoring to deliver faster, and smarter tunnels.

How we help

- Work with up-to-date geotechnical data by establishing a dynamic connection to OpenGround
  - Your project automatically stays in sync with the latest subsurface data, ensuring accuracy throughout the design process
  - Import the latest geotechnical changes directly into your project design, reducing manual data handling and eliminating errors
- Unified design and analysis
  - Use OpenTunnel Designer to generate tunnel-specific geometry
  - Integrate with PLAXIS to analyze stress, deformation, and stability under changing loads
  - Eliminate disconnected handoffs between ground and structural models
- Seamless repair and phasing coordination
  - Simulate construction scenarios using SYNCHRO
  - Model staged tunnel lining rehabilitation or cut-and-cover interventions with time/cost alignment
  - Reduce disruption and increase accuracy in field execution
- Predictive monitoring with digital twins
  - Use iTwin Experience to centralize inspection reports, sensor data, and 3D geometry
  - Create a live, continuously updated view of the tunnel asset for stakeholder confidence
  - Plan rehabilitation using deterioration history, not assumptions

What makes Bentley different?

Technology	**Impact**
OpenGround	Secure, enterprise solution for geotechnical information management that facilitates access to factual data for analysis and modelling
Leapfrog	3D geological modelling for combining disparate subsurface datasets with intuitive interpretation
PLAXIS	Advanced soil-structure interaction and reinforcement modelling and tight integration with OpenTunnel Designer for tunnel design validation as part of a connected workflow
SYNCHRO	Plan, optimize, and track tunnel projects for greater certainty and fewer risks in construction

OpenTunnel Designer	Tunnel-specific modeling software, interoperable with bridge, rail, road, and geotechnical tools.
iTwin Experience	Creates tunnel digital twins combining design, inspections, and monitoring in one view.

Real-world impact: Case studies & success stories

Tecne Systra Improves Safety and Sustainability of Italy's Decades-old Autostrade Tunnels (case study, video, Seequent blog: Digital innovations drive sustainable management of Italian tunnels)

- ✓ OpenTunnel Designer reduced modeling time by 25% and project delivery time by 21.5%
- ✓ Working in an integrated digital platform reduced time for clash avoidance between structural and waterproofing and drainage
- ✓ collection systems by 30%
- ✓ The combination of Bentley and Seequent applications reduced project time, saving €26,533 in resource hours costs

Why choose Bentley tunnel design, analysis, repair, and rehabilitation?

- ➢ Unifies subsurface, design, and construction planning tools
- ➢ Integrated Seequent geotechnical workflows inside every design
- ➢ Accelerates inspection, simulation, planning, and project delivery
- ➢ Supports digital delivery mandates and sustainability goals

Quick Pitch

- ➢ Bentley enables tunnel owners and engineers to move from reactive maintenance to predictive, data-driven renewal, reducing risk, downtime, and cost.
- ➢ With our digital tunnel workflows, agencies can detect emerging threats, simulate repair strategies, and coordinate rehabilitation, delivering safer, smarter tunnels with fewer surprises.

Messaging Theme

- Accelerate tunnel renewals by integrating condition, ground data, and risk analysis into one environment.
- Plan phased tunnel repair with confidence, before you close a lane, open a model.
- Use digital twins to go from reactive inspection to proactive performance management.

Resources Links

- Transportation Industry Playbook
- Ground Engineering Playbook
- Transportation Subsurface Message Model
- WIP_Talking points - Engineering Excellence Starts Below the Surface.docx
- Transportation Product & Industry Knowledge Center
- Seequent Product & Industry Knowledge Center