Performance of Composite Liner: Shotcrete and Thin Spray-on Liner (TSL)
Shotcrete

- sprayed onto the rock
- part of a support system
- strength increases over time

- sprayed concrete
- cement, aggregates, water with or without fibre reinforcement
- thickness between 50 mm to 100 mm

TSL

- liquid (polymer) and powder (cement)
- thickness between 3 mm and 5 mm
Advantages of TSLs

- Superior tensile and bond strengths and yield characteristics
- Application time is shorter (quicker)
- Equipment is smaller and therefore maintenance is much simpler
- Significant time savings in materials handling
- User friendly and cost effective
- Do not require large amounts of capital to be spent setting up plants
Shotcrete and TSL Applications

- Reducing the water permeability of the shotcrete lining (Hawker, 2001),
- Repairing shotcrete (Lacerda and Rispin, 2002)
Question

- Is it possible to reduce the shotcrete thickness?
- Can this reduction be achieved by TSL application over or under shotcrete?
- Shotcrete performance should remain the same.
TSL laboratory tests

**On Rock**
- **Enhance the strength of rock**
  - Up to 40%

(Tarr et al 2006) (Mpunzi, 2011)

**On Shotcrete**
- **Tensile strength increased by 40% after 28 days**

Masethe (2015)
Comparison of Mechanical Properties
Bond Strength (Tensile)
Bond Strength (Shear)
Tensile Strength

Graph showing the tensile strength of shotcrete over different curing periods.
Compressive Strength (TSL)

\[ y = 3.5829 \ln(x) + 16.328 \]

\[ R^2 = 0.8701 \]
Compressive Strength (TSL)

\[ y = 1.2833 \ln(x) + 15.914 \]

\[ R^2 = 0.9307 \]
Compressive Strength (TSL)

\[ y = -0.0002x + 0.2024 \]

\[ R^2 = 0.0824 \]

Curing Period (Days)
Questions;

- Would the contribution of TSLs on shotcrete performance be formulated?
- Is it possible to reduce the shotcrete thickness when it is used in combination with a TSL?
- Is there any difference on shotcrete performance if the TSL is applied over or under shotcrete?
Suggested scenarios to be examined
QUESTIONS???