ADVANCED PLS SOFTWARE USE IN SOUTH AFRICA

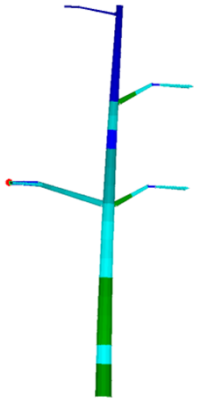
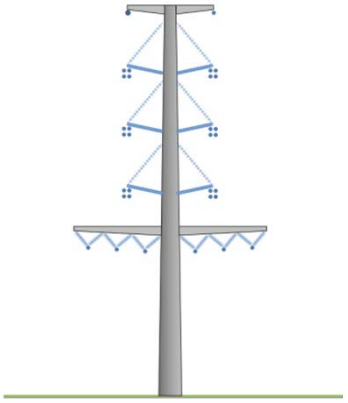
TRANS-AFRICA PROJECTS

Eskom







TRANS-AFRICA PROJECTS

Trans-Africa Projects (TAP) is a design consultancy based in South Africa.

Shareholding:

Eskom

FLUOR®

TAP has the capacity to supply:

- Power Network Engineering and
- Project Management Services

on voltage levels ranging from 11kV to 765kV.

We are also the agents for POWER LINE SYSTEMS · INC · in Southern Africa.

BACKGROUND

A bit about me:

- Structural Engineer
- Line Designer with TAP ≈ 3 years
- Constant exposure to PLS software
- Recently started providing PLS training courses
- Hence my presence here at the ATUG meeting

CONTENTS

An overview of some of the more interesting projects in which we have used PLS suite of software.

- Invisible Tower
- Long-Span Crossing
- Caprivi Link Interconnector (Namibia)
- Bent monopoles
- Sculpture Towers

INVISIBLE TOWER

Project background:

Challenging 400kV line which TAP designed in the Western Cape of South Africa

- Close proximity to:
  - Existing 66kV and 132kV lines
  - Bulk services pipelines
  - Highway servitudes
  - Residential areas
  - Informal Settlements
- Environmental challenges:
  - Poor/sandy soils
  - Red data species
  - Wetlands
  - Vineyards
  - Mountainous areas

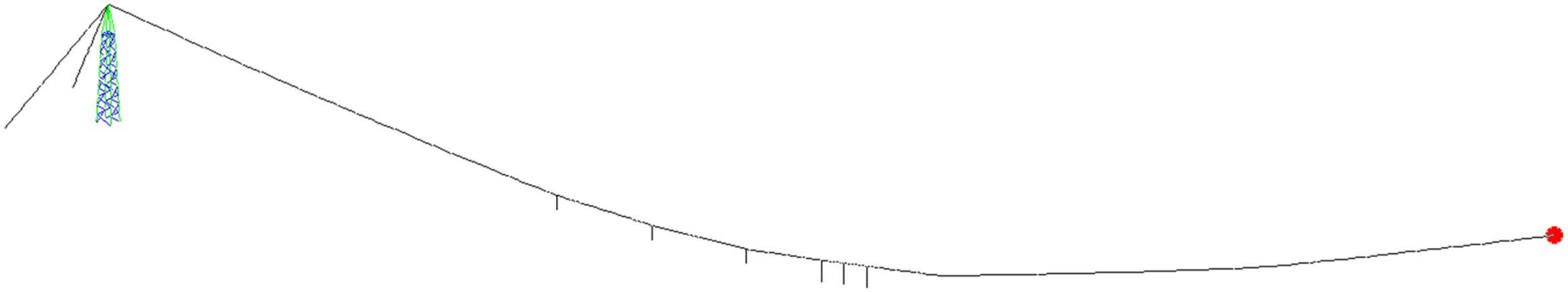
INVISIBLE TOWER

The line crossed a steep mountain ridge, right next to public viewing area. The main design requirement was:

Limit the Visual Impact of the line crossing the ridge.

This was eventually achieved with by designing and installing the first Catenary structure in South Africa:

- LIDAR survey accurately determine relative elevations
- Integration between PLS-CADD & PLS-TOWER
- 1 chance to get it right - Not possible to test the structure

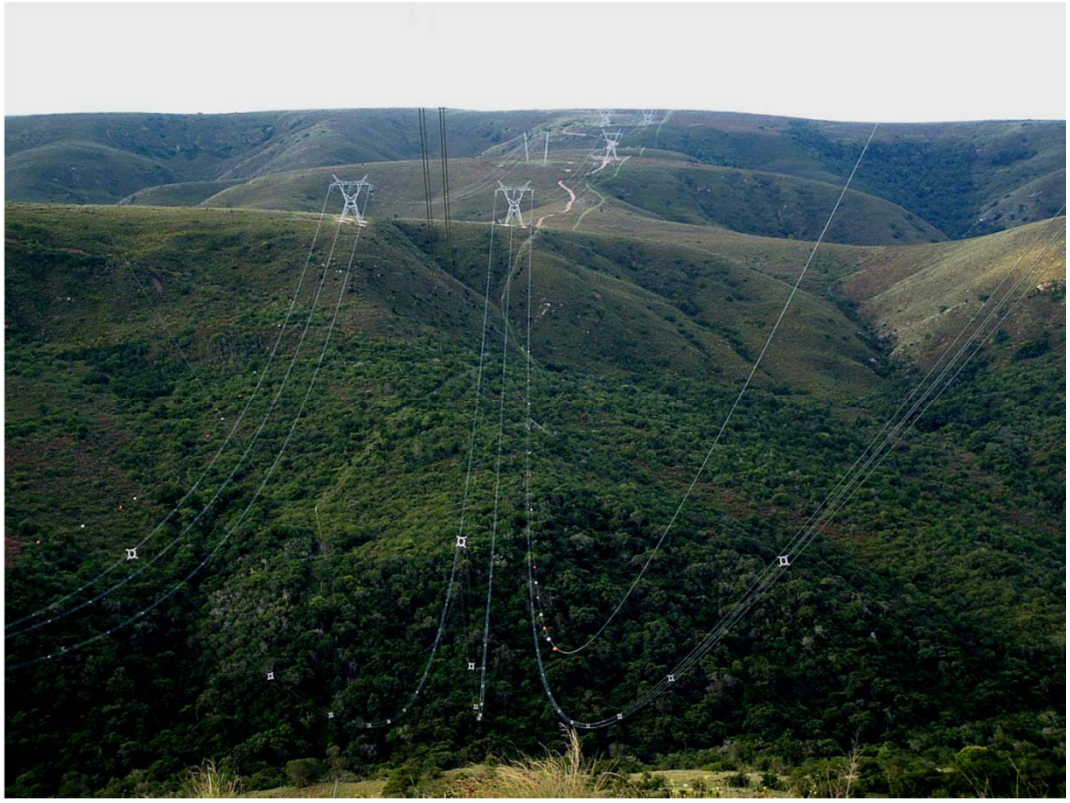


INVISIBLE TOWER

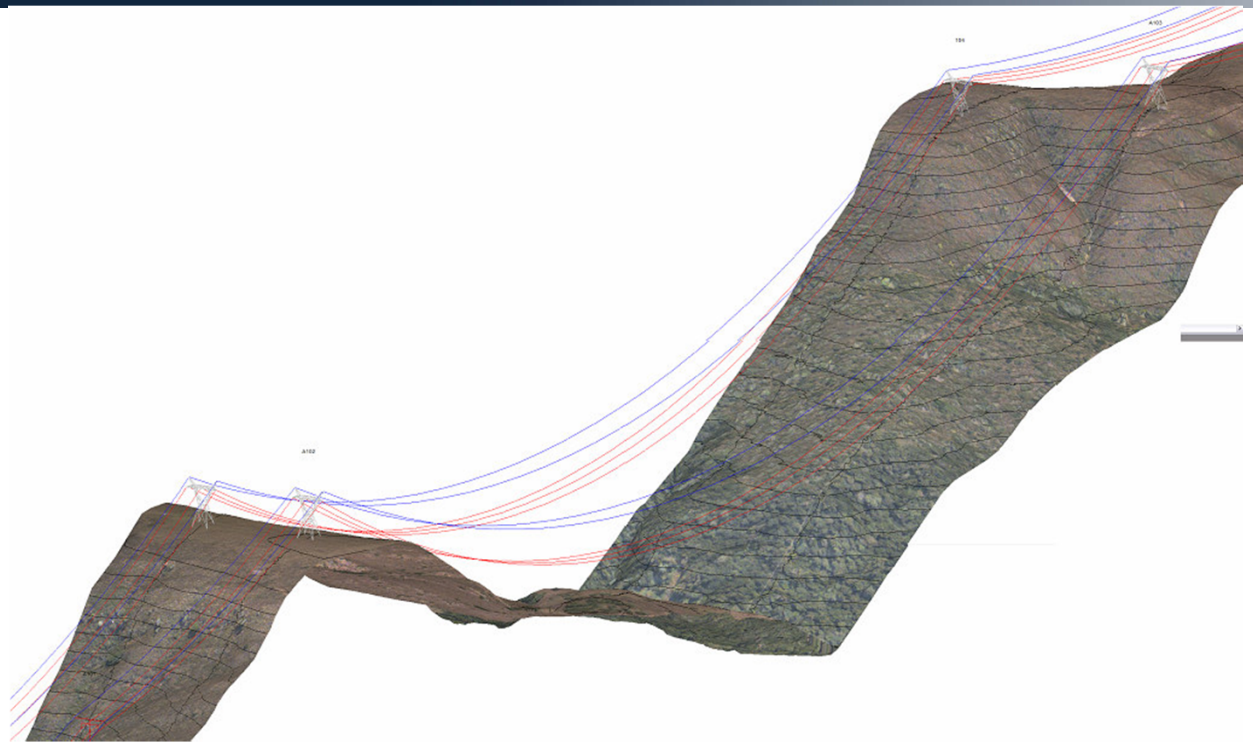
LONG SPAN CROSSING

A number of design challenges faced by Eskom on the project, included the crossing of a 225m deep, 1500m wide valley in the Addo National Park.

The design thus enabled the elimination of tower construction on the mountain slopes, in relatively difficult and environmentally sensitive terrain.



LONG SPAN CROSSING



- Lines supported by single structures on either end
- Time and budget constraints:
  - Existing designs were assessed for suitability
  - Using sophisticated FEM modelling in PLS TOWER and PLS CADD

LONG SPAN CROSSING

Design adaptations:

- Increased wind loading
  - Method 4 structure models with Level 4 cable models
  - Increased loading due to terrain

- Line and Phase spacing
  - Line spacing 100m (asynchronous conductor movement)
  - The centre phase was raised by increasing regulation tension by 2%

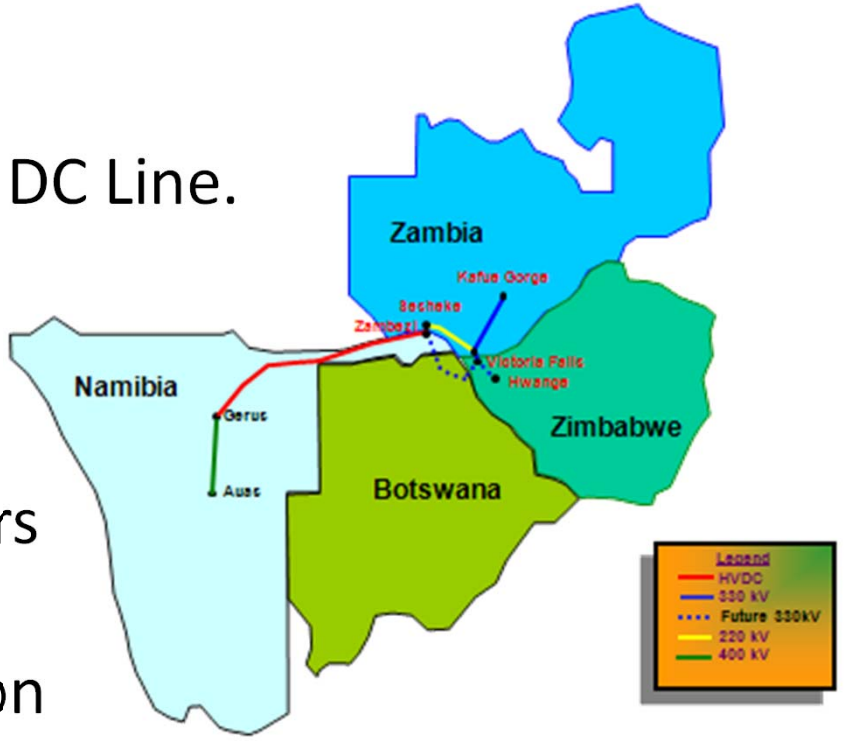
CAPRIVI LINK INTERCONNECTOR

Interconnector link between Zimbabwe, Zambia, Botswana and Namibia (ZIZABONA).

Phase 1 of the project was the ±350kV DC Line.

Project highlights:

- 950km (80m servitude)
- Crossrope and self supporting towers designed and tested in South Africa
- First use of HVDC Light technology on long OHTL
- Cost per km ≈ USD $ 0.2 million / km
- Up 22 structures erected per day



CAPRIVI LINK

PLS software was instrumental in:

- PLS TOWER used to optimise structure designs
- PLS CADD Optimum Spotting reduced costs further.

BENT MONOPOLES

531 Series of Monopoles:

- Only 400kV poles in South Africa
- Largest Poles for OHTL in SA (CAH up to 38m)
- Tapered steel poles
- Varying wall thicknesses

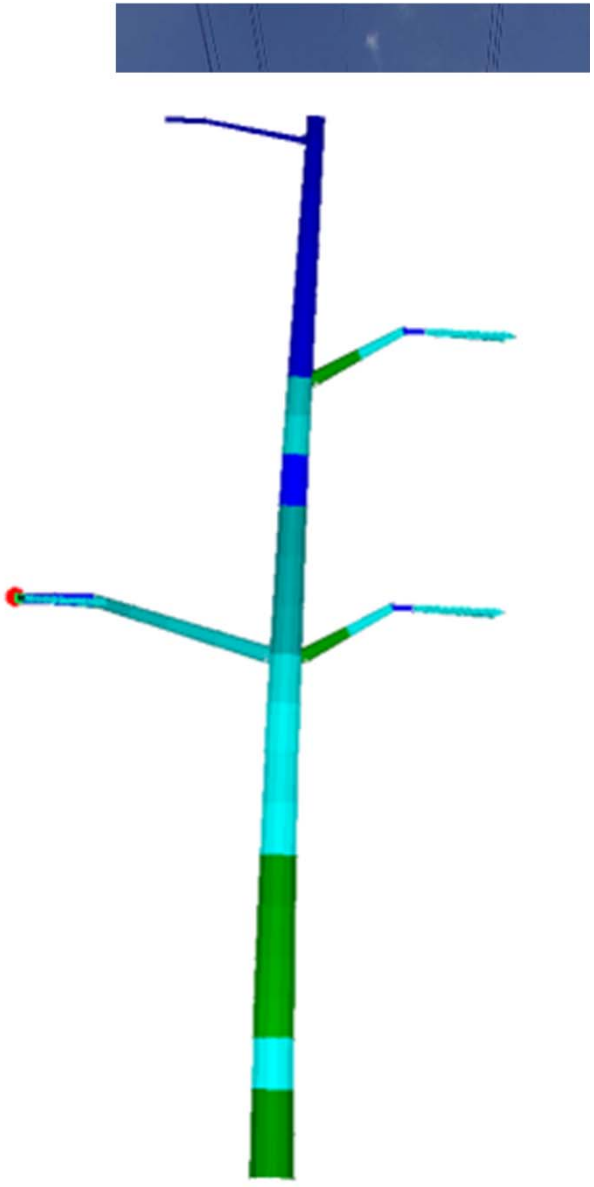
The Angle Strain Poles are Bent!

- Joint slip has occurred – not just deflections
- Low jacking forces
- Poor fabrication tolerances
- Galvanizing? Loss of aesthetics

BENT MONOPOLES

Investigating if we have structural issues with the resulting “bent” poles

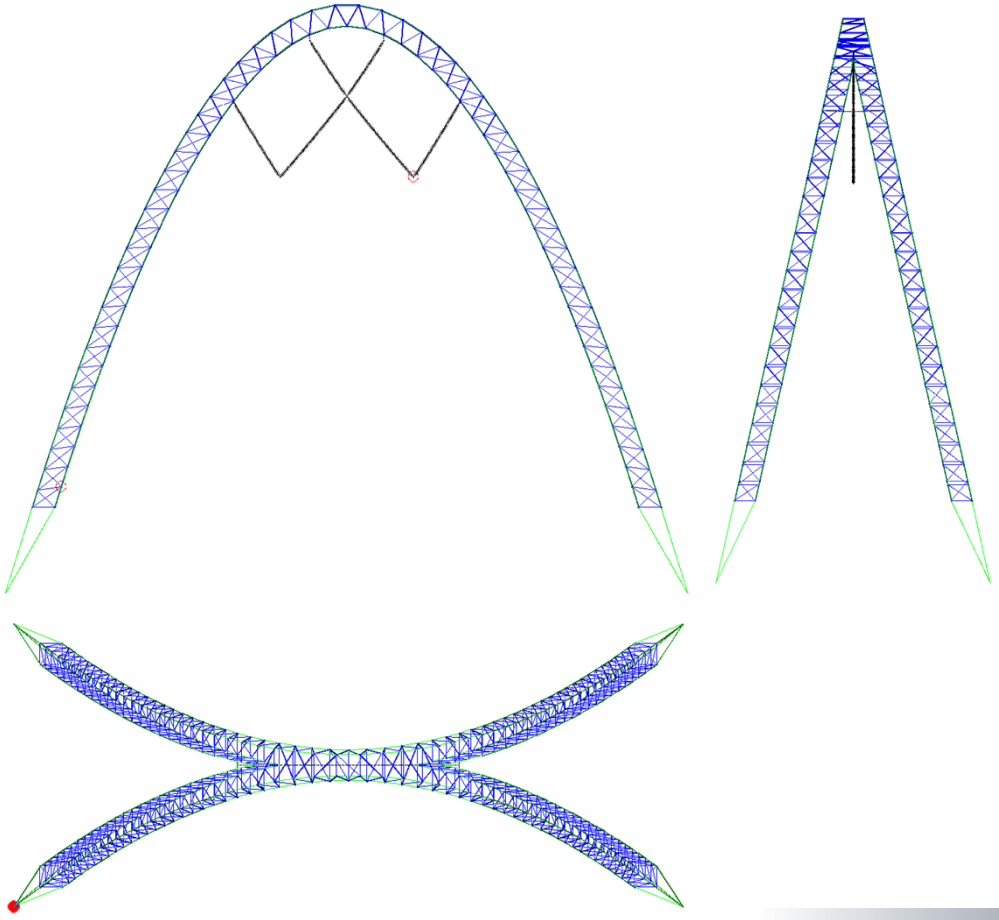
- PLS-CADD Line Profile & Method 4 pole structures to determine tip deflection under EDT conditions
- 3D Survey of the poles
- This shows what the permanent joint slip is at each slip joint
- Create the imperfect geometry pole model in PLS POLE
- Re-import into Profile & determine if any structures are now over-utlised



SCULPTURE TOWERS

- Sometimes its nice to add a bit of flair
- Convince the financial side of the business

We have played around with a Arch Tower



QUESTIONS

Thank you very much!

Any questions?

Graeme Louw
Line Design Engineer | **Trans-Africa Projects (Pty) Ltd**
Tel: +27 21 914 3813 | Mobile: +27 72 402 6010 | Email: graeme@taprojects.co.za