

Optimisation of Transmission Line Design in Mountain Regions using Advanced Cartographic Techniques and LiDAR

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Introduction

- Optimisation of transmission line designing in plain area is easy .
- But in the rocky mountains, the elevation changes are more and ground condition varies.
- So, application of advanced Cartographic, GIS techniques and 3D visualisation tools over the line route is very much necessary to finalise the optimal route and Tower types required to achieve low cost designing possible.
- Many challenges faced by the designers and solutions to address these issues using latest available Cartographic, GIS and 3D visualization techniques.
- Also, analysed many software available, those are inter-relates Terrain condition with the Electrical and Mechanical calculations of the transmission line like PLS-Cadd, JOVE, etc.
- Development of the high resolution 3D terrain model along the route is the major task to achieve more stable and economic approach to design the transmission line.

- Transmission line designing is becoming globalised as every power line companies looking for the optimisation techniques to reduce the cost of the transmission line designing and maintenance.
- As the cartographic techniques plays major role at the initial and maintenance stage.
- Recent development in the LiDAR technology to collect more accurate and latest data of the existing line and new line made the designers and maintenance engineers to make accurate designing and future planning of the transmission line.
- The resulting LiDAR data set produced a digital terrain model of the ground surface and a catenary model of the overhead lines.
- It is also possible to integrate these images into modeling programs and view the terrain model with an image overlay simulating the true relief of the right of way.

Mosaic of Toposheet for Route Alignment



Transmission Line View in Google Earth



Transmission Line Route Alignment Design

- For new transmission lines route alignment design, accurate terrain and features measurement is necessary to select the most feasible route technically and economically.
- Features such as existing transmission line catenaries, road, building rooftops, etc. must be precisely mapped in 3D to review their effect on a proposed new transmission line.
- The new transmission line should be reviewed by designer before going to site and as such, should follow these important 3 stages.

First stage

- where the area between the start and end substations is mapped in detail for terrain, geography and features that may affect clearance.
- Airborne LiDAR is optimal for these purposes as it is able to collect large areas of highly accurate and dense topographical and features information in digital 3D format in a short time.

second stage

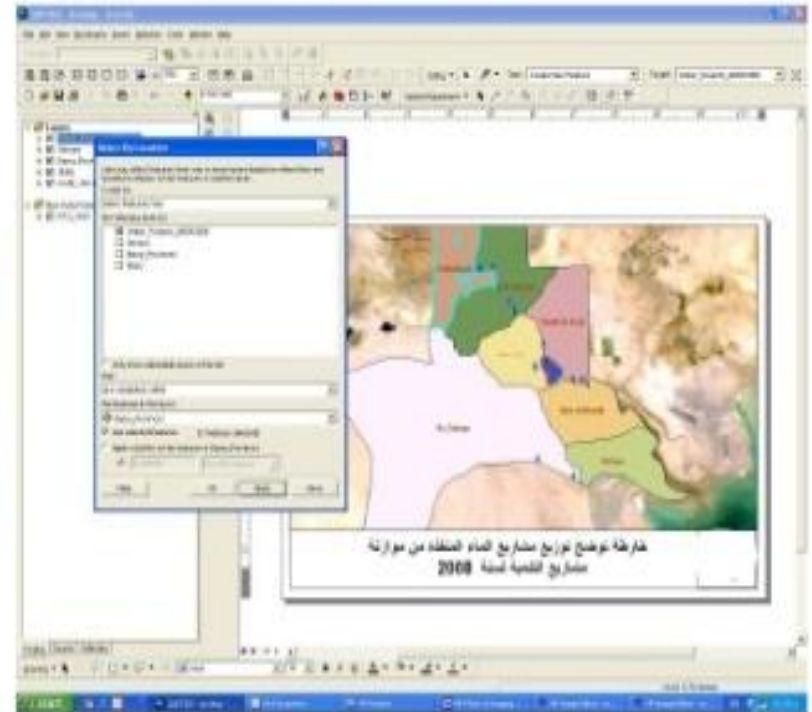
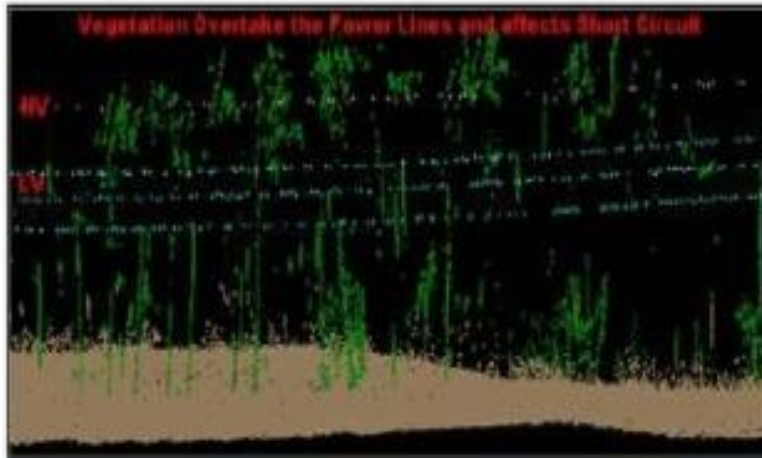
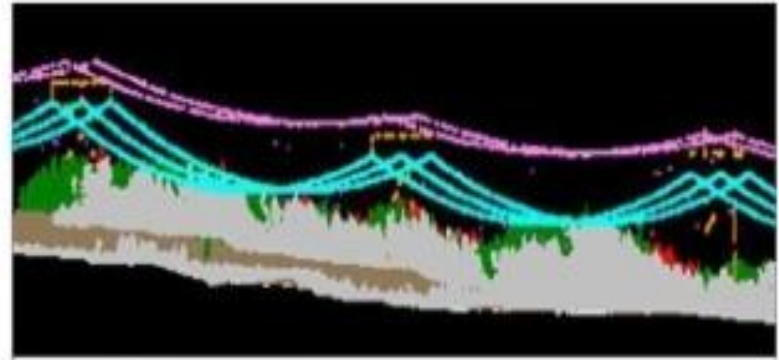
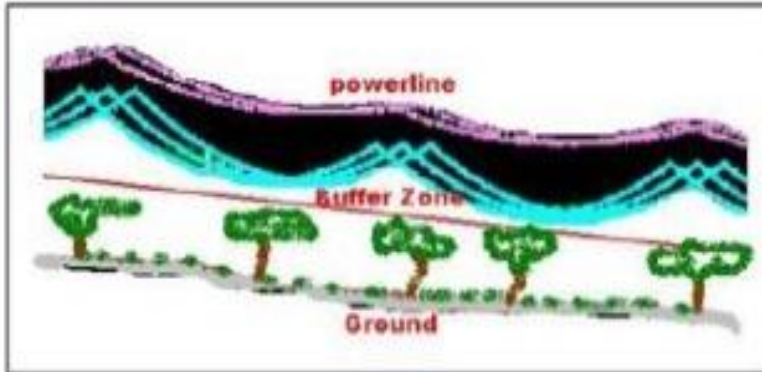
- The PLS-CADD software translates the survey data into a readable format where data points are feature coded with labels such as trees, roads, rivers, settlements, street furniture, rooftops, etc.
- These labels enable the software to check clearance violations during the Optimum Spotting process.
- The feature coded data points can be filtered in and out of the software to display certain aspects of the terrain information at different stages of the tower spotting process.

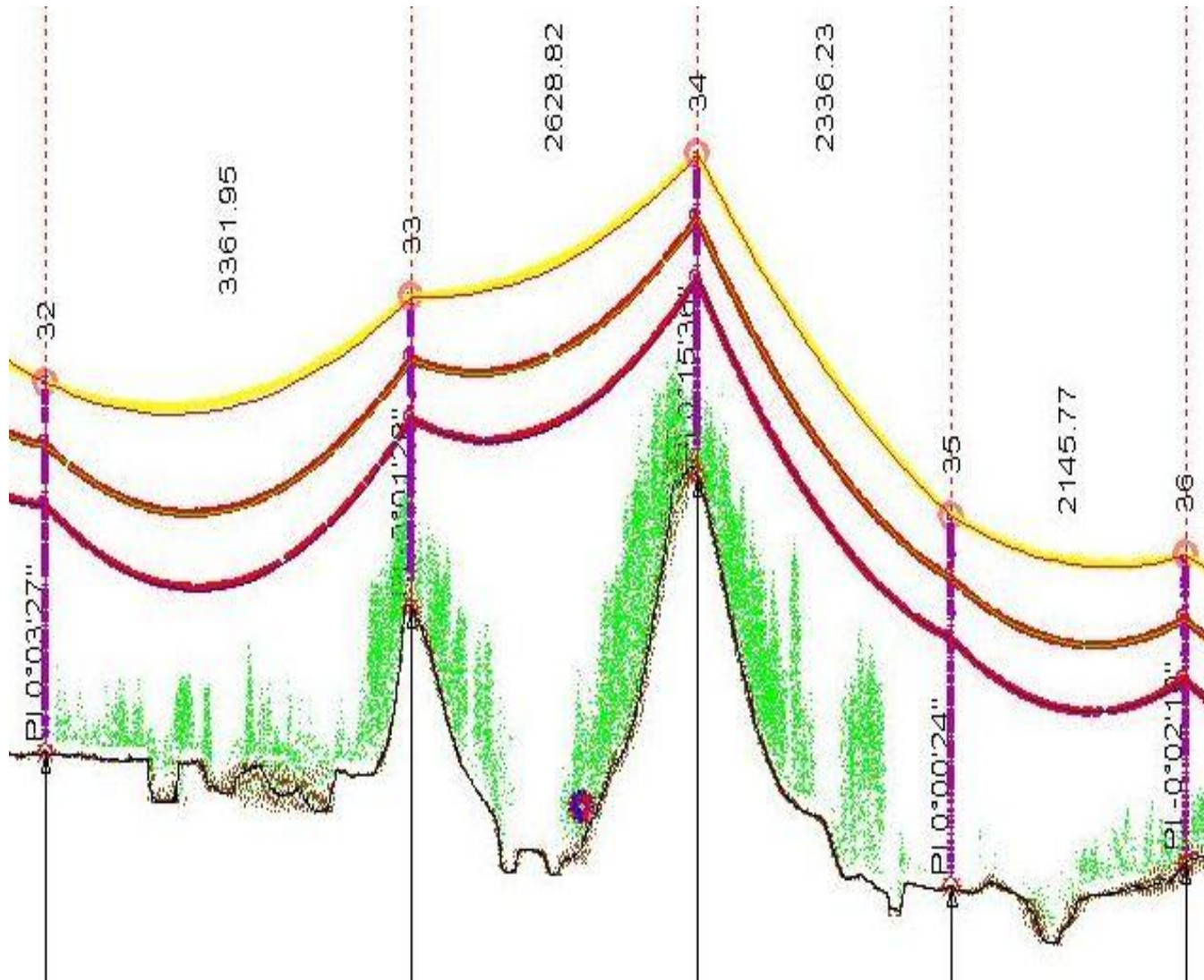
Last stage

- The **last stage** is “Optimum Spotting” where based on the highly accurate and dense data produced from above stages
- The PLS-CADD software spots the various intermediate structures at optimum locations for minimization of number and cost of towers.
- Several options exist where PLS-CADD allows for optimization of structures based on parameters that include the cost of the structure.

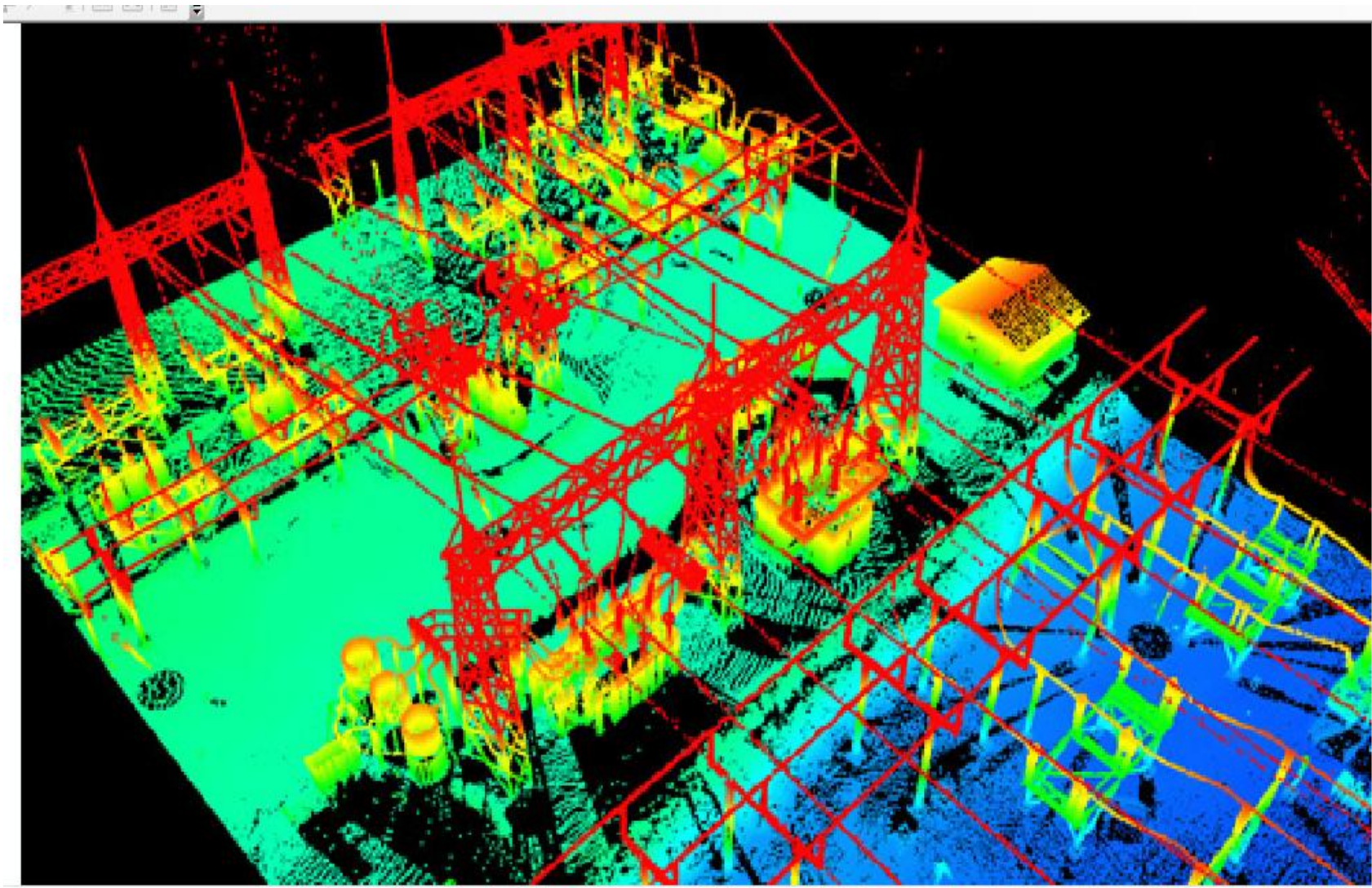


Different Classification of LIDAR data





LIDAR data of Transmission Line



LIDAR data Transmission Line Substation

Transmission Line in Mountain Region



