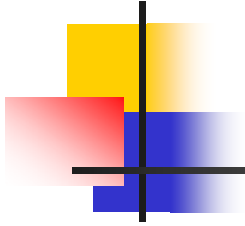




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Introduction of PLS-CADD



Background

PLS-CADD

Power Line Systems

- Computer Aided Design and Drafting

the most powerful overhead power line design program on the market

- runs under Microsoft Windows
- features an easy to use graphical user interface.
- integrates all aspects of line design into a single stand-alone program with a simple, logical, consistent interface.



Background

Its **sophistication** and **integration** leads to

- ✓ more cost-effective designs being produced
- ✓ only a fraction of the time required by traditional methods.

The PLS-CADD solution is so clearly superior to any alternative that in the last five years alone, it has been adopted by more than 100 organizations in over 70 countries.



Three Dimensional Engineering Model

The heart of PLS-CADD is a sophisticated three-dimensional engineering model.

- the terrain
- the structures
- all the wires

The model can be viewed in a number of different ways:

- profile views
- plan views
- plan & profile sheets
- 3-D views
- staking lists...

Three Dimensional Engineering Model

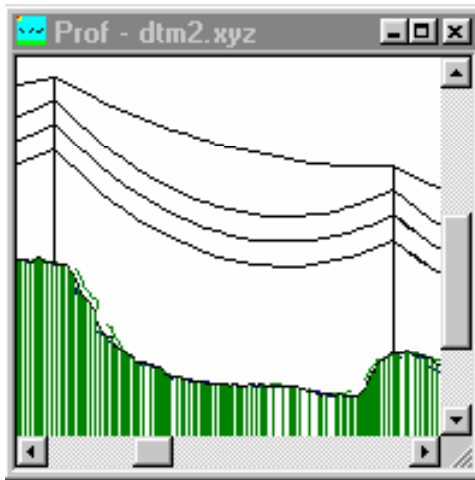


Fig.1) profile views

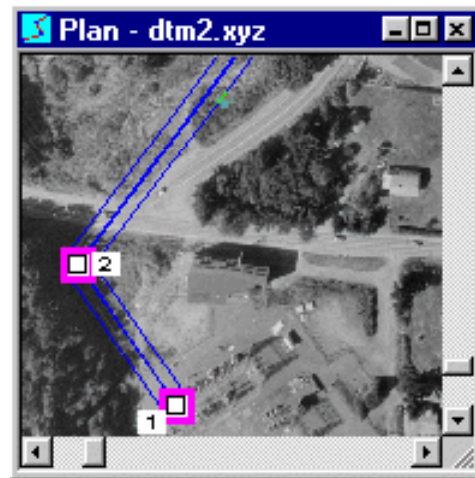


Fig.2) plan views

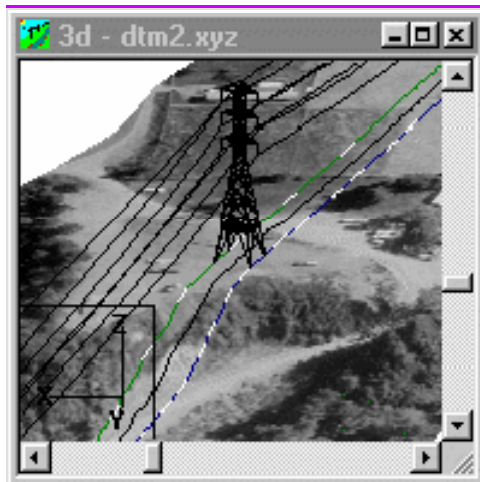


Fig.3) 3-D views

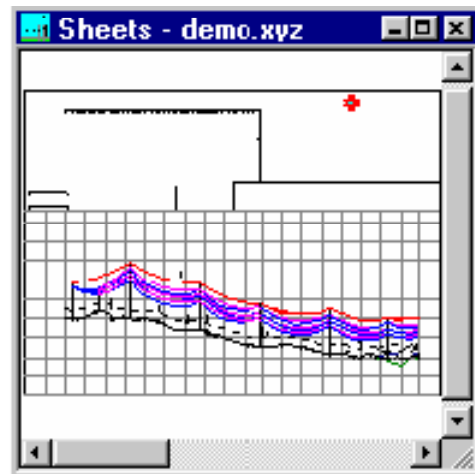


Fig.4) plan & profile sheets



Three Dimensional Engineering Model

The PLS-CADD model is much more than just a picture or CAD drawing since PLS-CADD understands the relationship between these elements.

When you drag a structure off the current alignment:

- New profiles will be generated
- All affected structure and wire positions are updated.
- The effects of this structure move will be instantly visible in all views including the plan & profile sheet view.

In PLS-CADD you concentrate on designing your line instead of wasting your time drafting.



Terrain Model

Having a customizable data import routine that can read a wide range of survey data formats, PLS-CADD easily adapts to the wide range of technologies used for line surveys including total station instruments, airborne lasers and photogrammetry.

- Survey data can be accepted in both the plan and the profile coordinate systems.
- Survey data can be keyed in, can be digitized using the built in heads-up digitizer, or can be electronically imported from a survey data file.



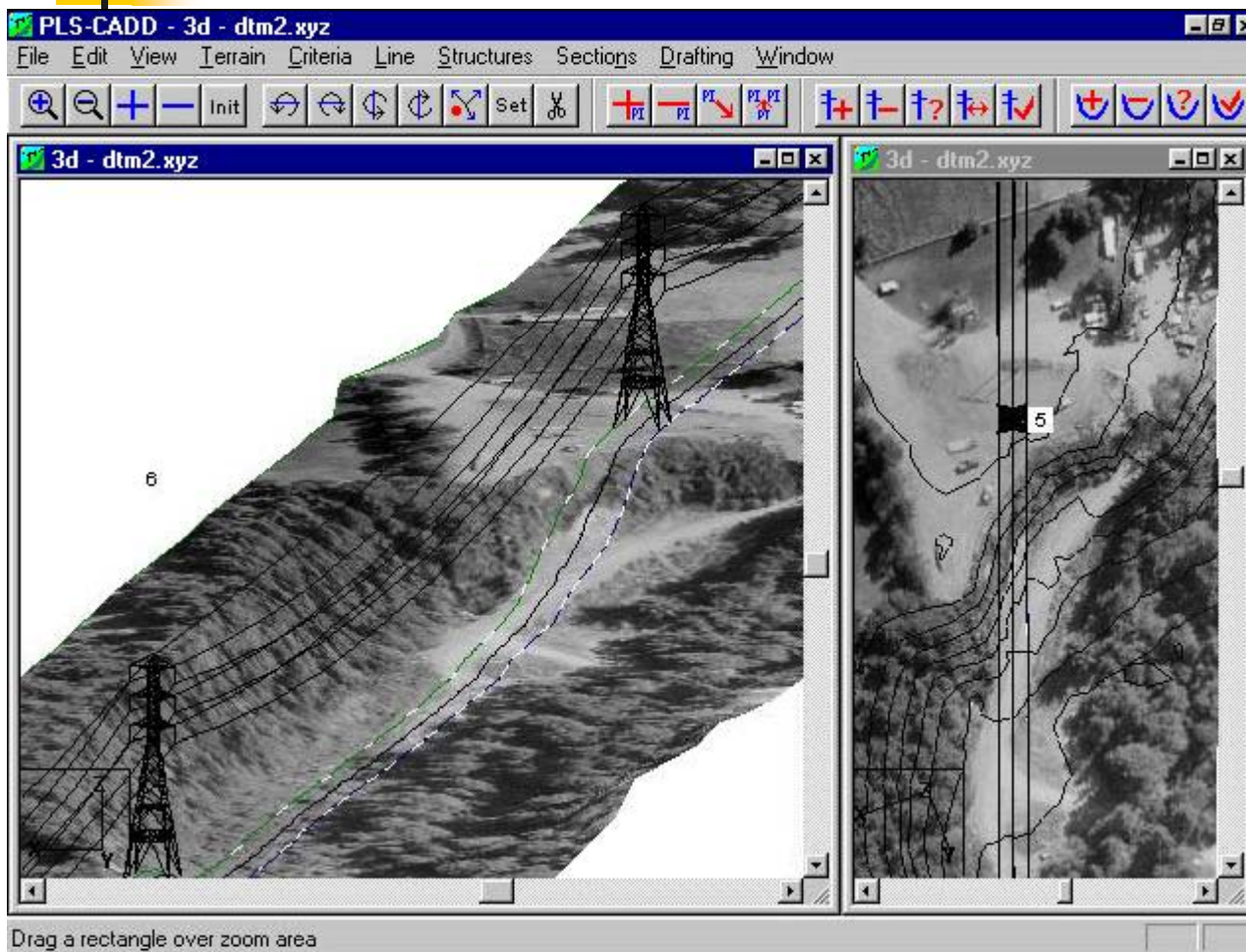
Terrain Model

Superposition of planimetric maps and aerial photographs can be used to better visualize the area around your line.

When sufficient data are available PLS-CADD can give you an even better perspective using contour lines, color renderings and even draped aerial photographs.

Altering your line route is easily accomplished by dragging P.I. points with the mouse or by clicking on locations where you want to add or delete P.I. points. Line route changes are instantly reflected in all views.

Terrain Model



The right pane of this image shows a top view of a line superposed over an aerial photo. The contour lines were generated from the digital terrain model and can be displayed at user selected intervals.

The left pane of the image shows an isometric view of the same section of line in the right pane. This image was created by "draping" the same photo shown in the left pane over a digital terrain model.

Fig. 9 PLS-CADD Contour Lines and Draped Bitmap

Terrain Model

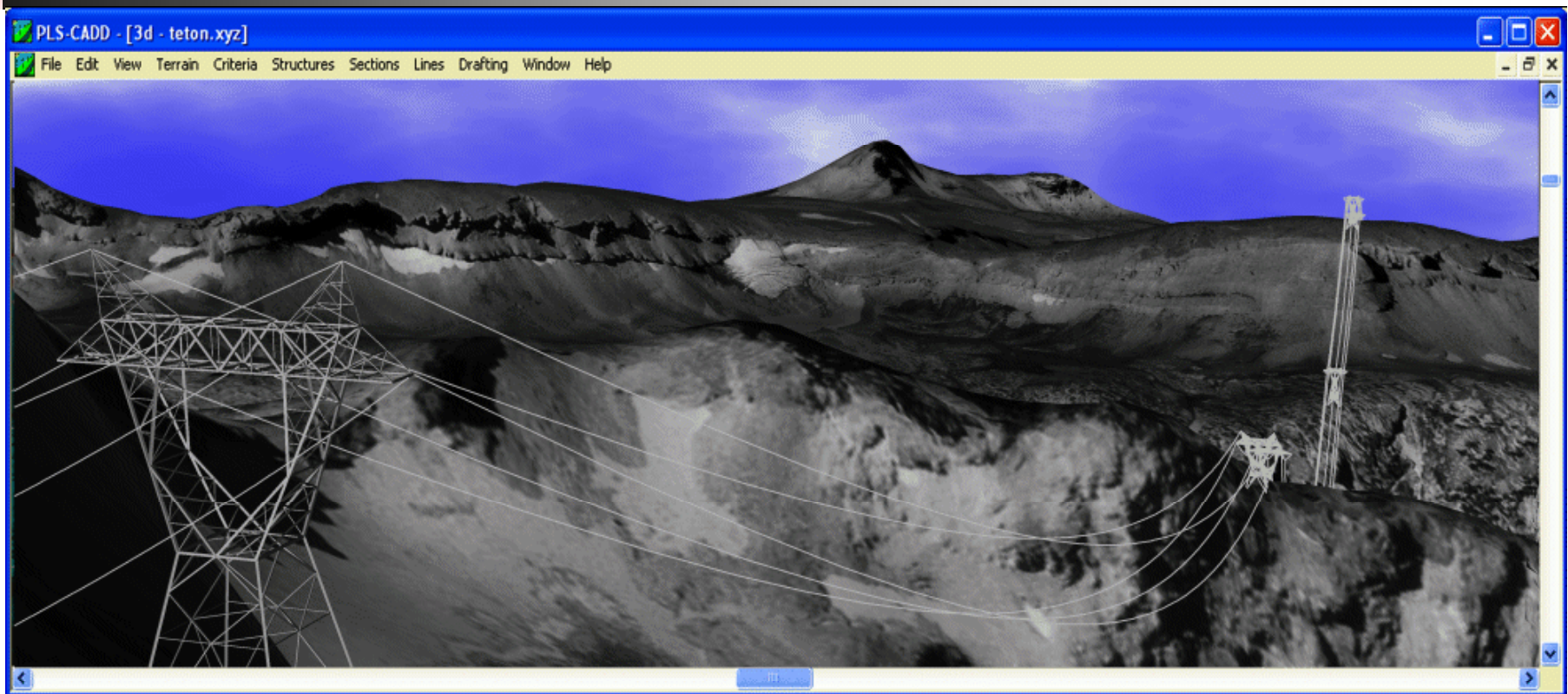


Fig. 1 PLS-CADD Rendered Digital Terrain Model

This image shows lattice towers modeled with TOWER software as spotted and strung within PLS-CADD. The PLS-CADD model features orthorectified photographs draped over a digital terrain model.

Terrain Model

This animation cycles through different representations of the same terrain:

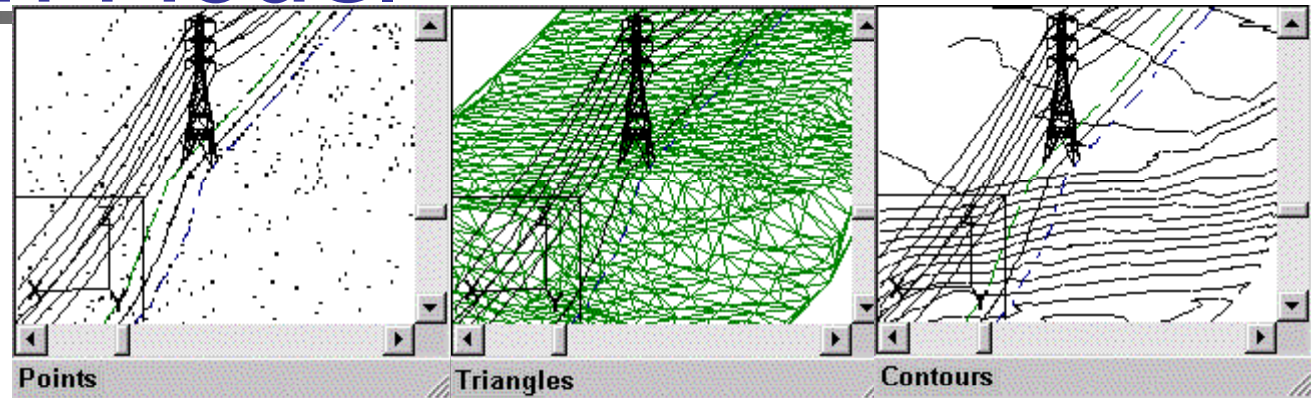
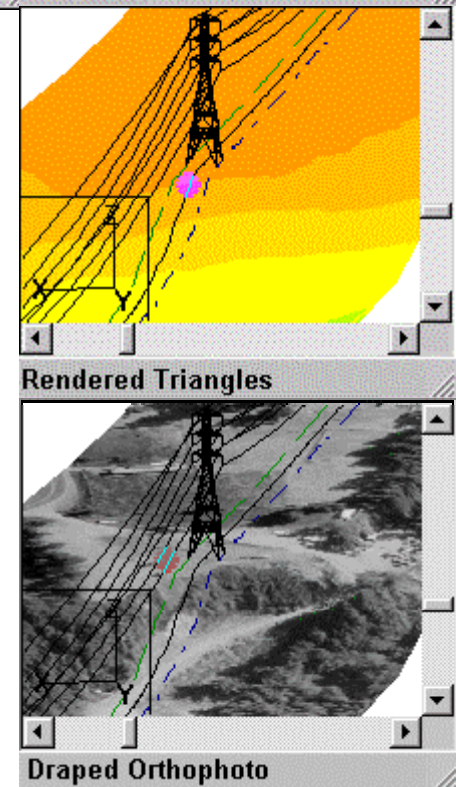


Fig. 4 Terrain Model Animation

- ✓ **Points**: Surveyed points are shown
- ✓ **Triangles**: Triangulated surface passing through surveyed points
- ✓ **Contours**: Contour lines at user specified intervals
- ✓ **Rendered Triangles**: Triangles filled with color as a function of elevation and line of sight
- ✓ **Draped Orthophoto**: Triangles filled with color from orthophoto





Engineering Standards & Calculations

PLS-CADD's engineering functions are very flexible and are easily adapted to conform to your standards.

- ✓ defining the combinations of wind, ice, temperature and safety factors you wish to use.
- ✓ tell the program which combinations to use for loading trees, for insulator swing checks, for clearance checks, wire tension checks...
- ✓ work in either imperial or metric units and can even switch back and forth between these unit systems.

The fact that over 100 countries use PLS-CADD is a testament to **its adaptability to a wide range of standards.**



Engineering Standards & Calculations

Once standards are setup you are only a few mouse clicks away from engineering calculations.

- Select "**Structure/Check**" and click on a structure and you are told if you have a structure strength or insulator swing problem.
- Select "**Section/Sag-Tension**" and click on a span and you get a sag-tension report.
- **Clearances, loading trees** and many other functions are just as easily accessed.



Engineering Standards & Calculations

PLS-CADD supports both automatic and manual spotting.

- Manual Spotting: you use the mouse to add, delete, edit or move a structure.
- Automatic Spotting: the program spots structures for you to obtain the lowest cost design possible subject to your constraints.

Automatic spotting often results in designs as much as 10% lower in cost than human generated designs.

PLS-CADD gives you the best of both the automatic and the manual spotting worlds: cost and time savings while still maintaining control.



Advanced Sag-Tension

PLS-CADD has built in sag-tension routines.

- You can quickly display your line in 3-d for any weather condition complete with insulator swings and wire blowout.
- Clearances from wires to ground or between phases can also be calculated under any weather conditions.
- Loading trees, stringing charts, galloping ellipses, IEEE Std. 738 thermal ratings, and offset clipping results are all easily accessed.

Advanced Sag-Tension

PLS-CADD goes beyond ordinary sag-tension programs. Running ACSR conductors at high temperature can cause the aluminum strands to go into compression.

- Most sag-tension programs do not model this effect and thus underestimate the sags.
- PLS-CADD can model your line both with and without the compression effect so you can see how severe it is.

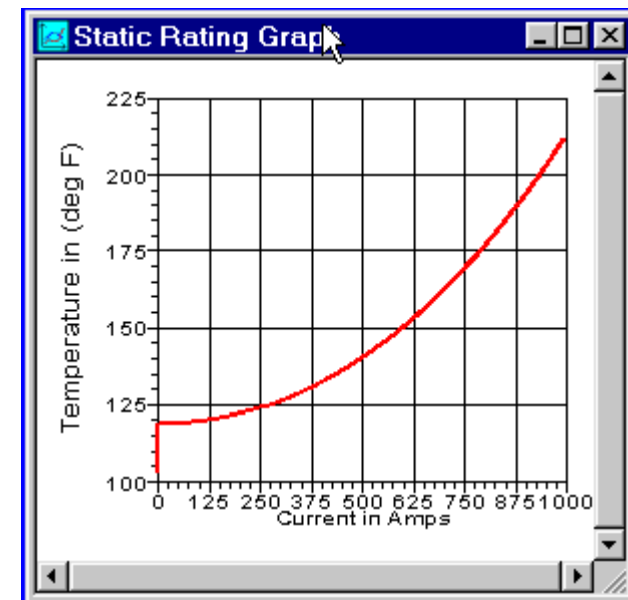


Fig. ^ The temperature of ACSR with changing current



Advanced Sag-Tension

In its sag-tension calculations, PLS-CADD uses

- ruling span approximations
- SAPS multi-span finite element sag-tension program

when the ruling span isn't appropriate, PLS-CADD bypasses its built in sag-tension routine and uses SAPS instead.

✓ It allows modeling of broken conductors, unbalanced ice, marker balls, and flexible structure scenarios that are incompatible with ruling span approximations.

✓ It also allows fixing the length of wire in each span to see the impact of moving structures, inserting structures or cutting out wire in an existing line.



Structure Modeling

PLS-CADD provides several methods for modeling structures.

- the wind & weight span method: the simplest you need only enter values of allowable wind & weight spans, allowable suspension insulator swing angles and the coordinates of the wire attachment points.
- structure programs: a far more powerful
These programs construct **a finite element model** from some basic input quantities such as pole height, pole class, cross-arm size and guy placement.



Structure Modeling

When such a structure is checked PLS-CADD tells you:

- if the structure is adequate
- displays a color-coded picture showing which parts of the structure are most highly stressed

Users have complete flexibility in

✓ changing tensions, conductors and loading agendas and can see the results of these changes on structure usage in seconds.

✓ accommodating guyed structures, frames and even lattice towers.

This method is ideal for upgrade studies of existing lines

Structure Modeling

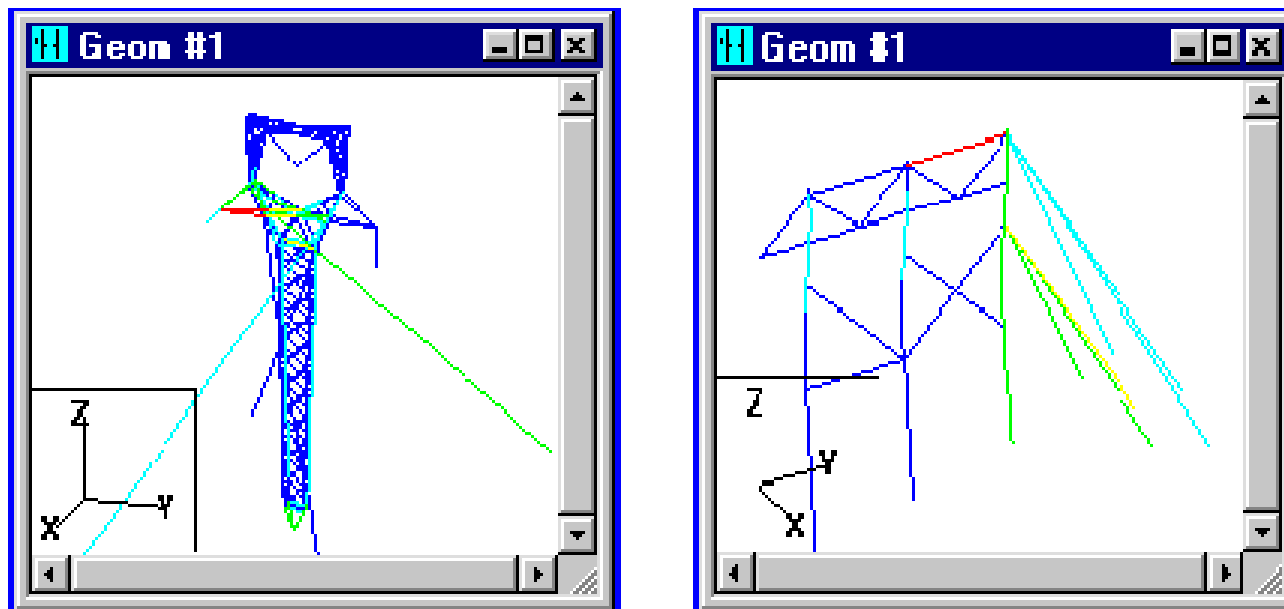


Fig. 9 Color-coded pictures for structure modeling



Material Subsystem

PLS-CADD features a powerful material subsystem for **cost estimation** and **material list generation**.

- Parts data such as stock-number, part description, cost and custom user defined columns can be entered directly into PLS-CADD.
- Assemblies can be created from parts and/or other assemblies.
- Alternatively, PLS-CADD can extract parts information from an existing company database.

All ODBC compliant databases such as Oracle, Access and DB² are supported and PLS-CADD is easily configured to access existing database schemas.



Material Subsystem

- Parts and assemblies are tied to structures enabling PLS-CADD to estimate the cost of structures or your entire line.
- A number of different material and staking list reports are available and can be easily exported to spreadsheets or ODBC databases for use in asset management or work order systems.



Drafting

PLS-CADD totally automates plan & profile sheet drafting.

- Plan & profile sheets are updated real-time as you make changes to your design. With a few keystrokes these sheets can be plotted to a Windows compatible printer/plotter or they can be imported into your CAD system.
- Custom drawing borders, title blocks and company logos are all automatically integrated into planimetric drawings and aerial photographs



Drafting

PLS-CADD adapts to your standards giving you full control over page size, page layout, text size, scales and many other sheet parameters.

Customers typically report that **PLS-CADD reduces their drafting time by over 90%.**

Drafting



Fig. 1 • PLS-CADD Plan & Profile Sheet With Page Border, Plan Overlay, Logo and Aerial Photo

This image shows a PLS-CADD plan & profile sheet featuring the following attachments:

PLANBCH.DXF: A DXF plan view drawing containing the tree lines, edges of roads, road names...

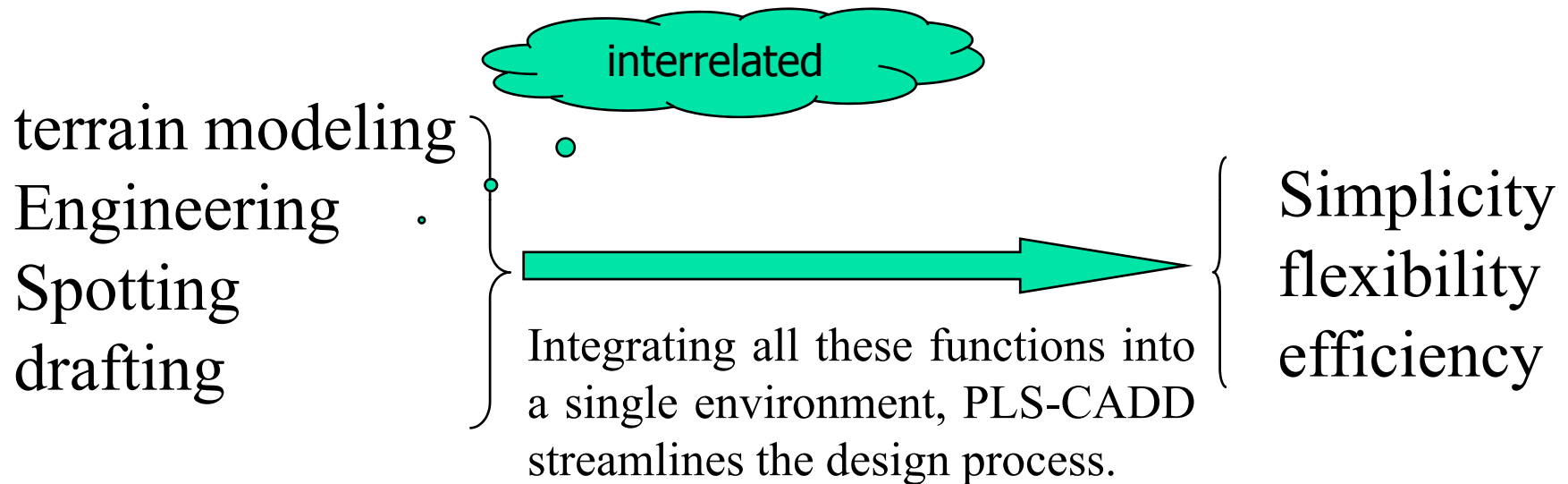
PAGEPLS.DXF: A DXF drawing of the page border and title block to be included on each sheet.

SOUTH.BMP: The aerial photo bitmap.

POWER.BMP: The Power Line Systems, Inc. logo bitmap shown on each page.

Summary

PLS-CADD addresses the reality:



- the state-of-the-art in sag-tension, structural analysis and automatic spotting.
- From distribution wood poles all the way to 500 kV or higher guyed frames and lattice towers, PLS-CADD has the power and flexibility to do it all.



Reference:

- ۱- SQL Plus users guide.
- ۲- Oracle data base online documentation.