NEW APPLICATION SOLUTION FOR ELECTRIC LINE DESIGN

Karel Noháč, Lucie Noháčová

ABSTRACT

Approach to design of outer electric lines has changed in last years very significantly. Especially new demands in branch reliability should designer keep in mind. These new requests are basis of new European and national standards. To simplify design layout, automate verification of all rules and limitations and minimize mistakes computer application was developed to solve these tasks.

1. INTRODUCTION

Design of outer electric lines is very complex problem, which contains solving questions not only in branch electric network, but also in branches mechanical dimensioning, geodetic measurement, reliability optimalization and environment consideration. Because of that a computer tool aiding to deal common tasks in main steps of design was developed and programmed.

Application “Electric Line Design” integrates these steps:

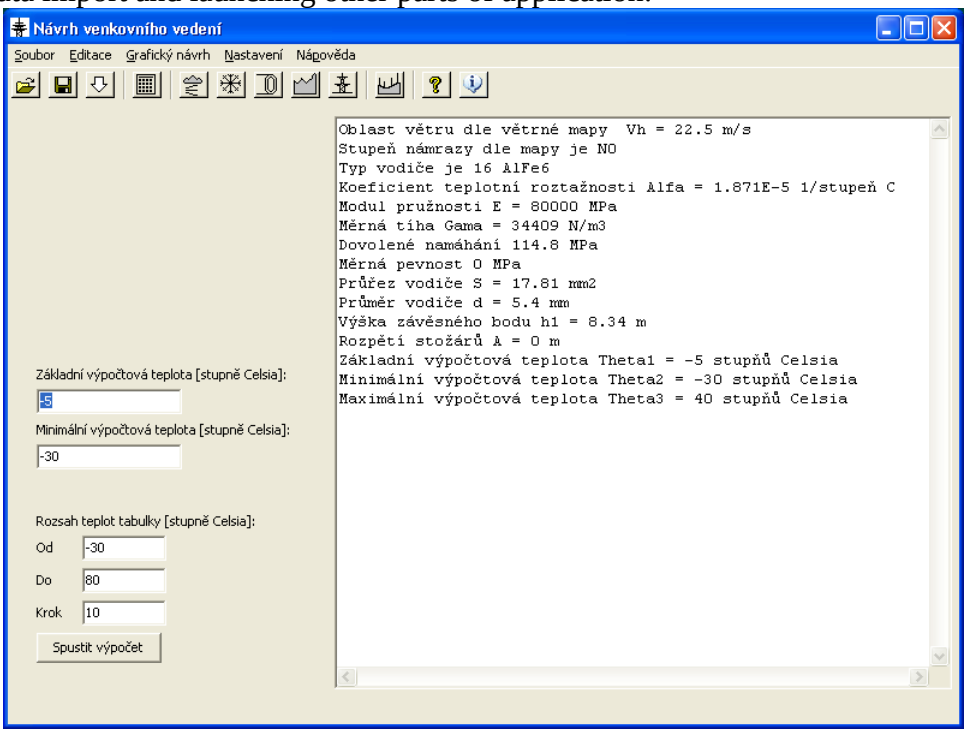
- Import of measured data of terrain in three dimension coordinate system, with possible additional information, like point name, comment of height point
- Graphical interactive pylon positioning, including selection of pylon and wire type, choice of basic horizontal wire stress and many other parameters
- Calculation of wire stress in different temperature and overload conditions for verification of maximal possible wire stress limitation and maximal pylon interval to keep distance between wires over minimal adequate value according to supposed conditions
- Calculation of wire stress, wire height and other parameters of wire shape between pylons to respect minimal distance of wire to every terrain important points
- Calculation of installation table of wire stress and deflection for demanded spectrum of temperatures
- Graphical export of created design in form suitable for many CAD applications to simplify project documentation

2. APPLICATION DESCRIPTION

Described application was developed in Borland® Delphi® for Microsoft® Windows™ Version 10 Turbo Explorer Edition.

Application layout includes two main windows: Starting window and graphical design windows plus few additional windows.

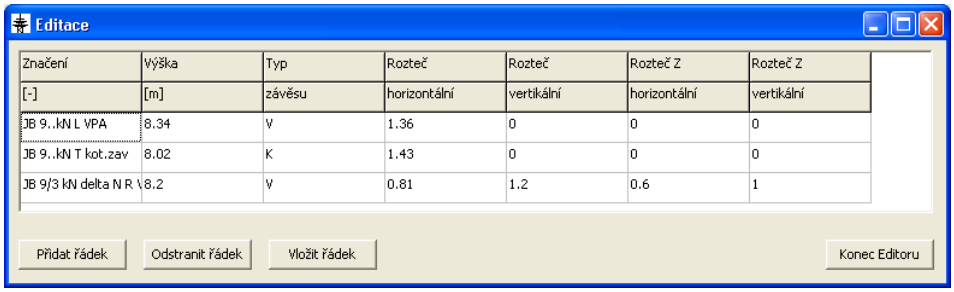
Starting window allows basic computation parameters management, file operations including data import and launching other parts of application:



Imported 3D terrain data must be in ASCII file format, position and format of data are arbitrary adjustable in application configuration file. File containing point number, 3D coordinates and point name can for example have following format:

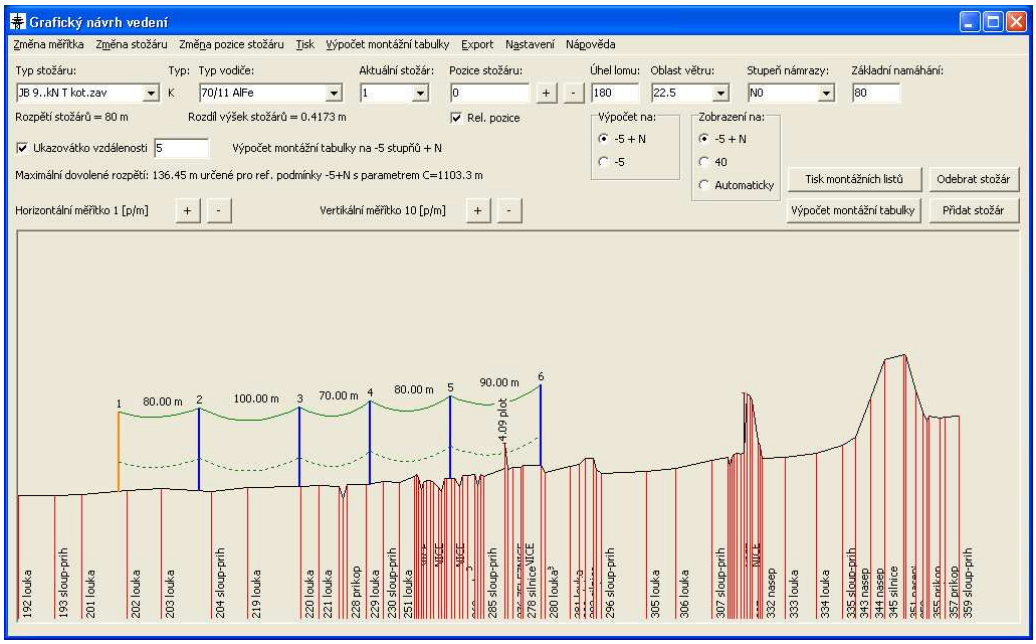
```
201        -909.256        611.315        303.395        meadow
202        -951.106        627.228        303.752        high point
203        -982.338        639.393        303.961        ditch
. . .
```

From basic window also editor of all tabular input data can be started. Here database of usual wire and pylon parameters, frost area parameters and wind area parameters can be changed and new elements in database added. For example pylon parameter editing looks following:

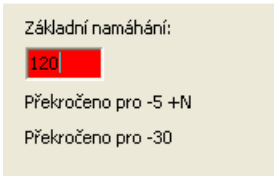


Graphical design window allows almost all other operations: Pylon type and position management, wire type and basic stress selection, line refraction angle value choice, wind area

and frost area selection, distance marker adjust, temperatures and conditions for stress limit computation and for displaying selection, graphical scales adjust and remaining parts of application launch:

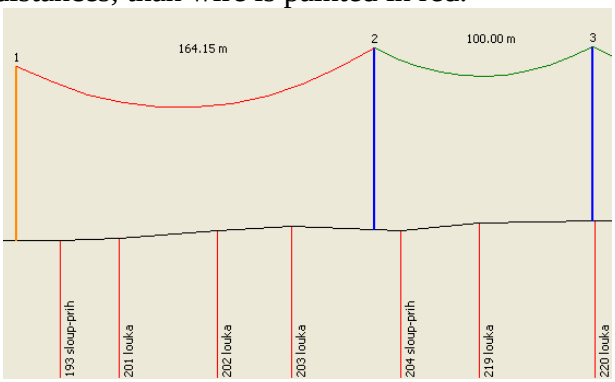


During line creation progress all necessary calculations are made. When maximum wire stress is exceeded, then specified basic stress is showed in red box. At the same time information message about error reason is showed in window.



Here exceeding for temperature -5 °C plus overload and for -30 °C is showed.

Similarly if maximum pylon span is exceeded and so wire deflection is bigger than allowed for current pylon and minimal wire distances, than wire is painted in red.



Adequately in generated calculation report all forbidden values of stress are marked with triple exclamation marks following:

Teplota *Temperature* **[stupně C]**	**Mech. namáhání** *Wire stress* **[MPa]**	**Průhyb** *Wire deflection* **[m]**	**ParametrC** *C-Parameter* **[m]**
-30	**116.32 !!!**	**0.98393**	**3423.2**
-20	**104.08**	**1.0997**	**3062.9**
-10	**92.433**	**1.2382**	**2720.2**
0	**81.589**	**1.4028**	**2401.1**
10	**71.764**	**1.5948**	**2112.0**
. . .			

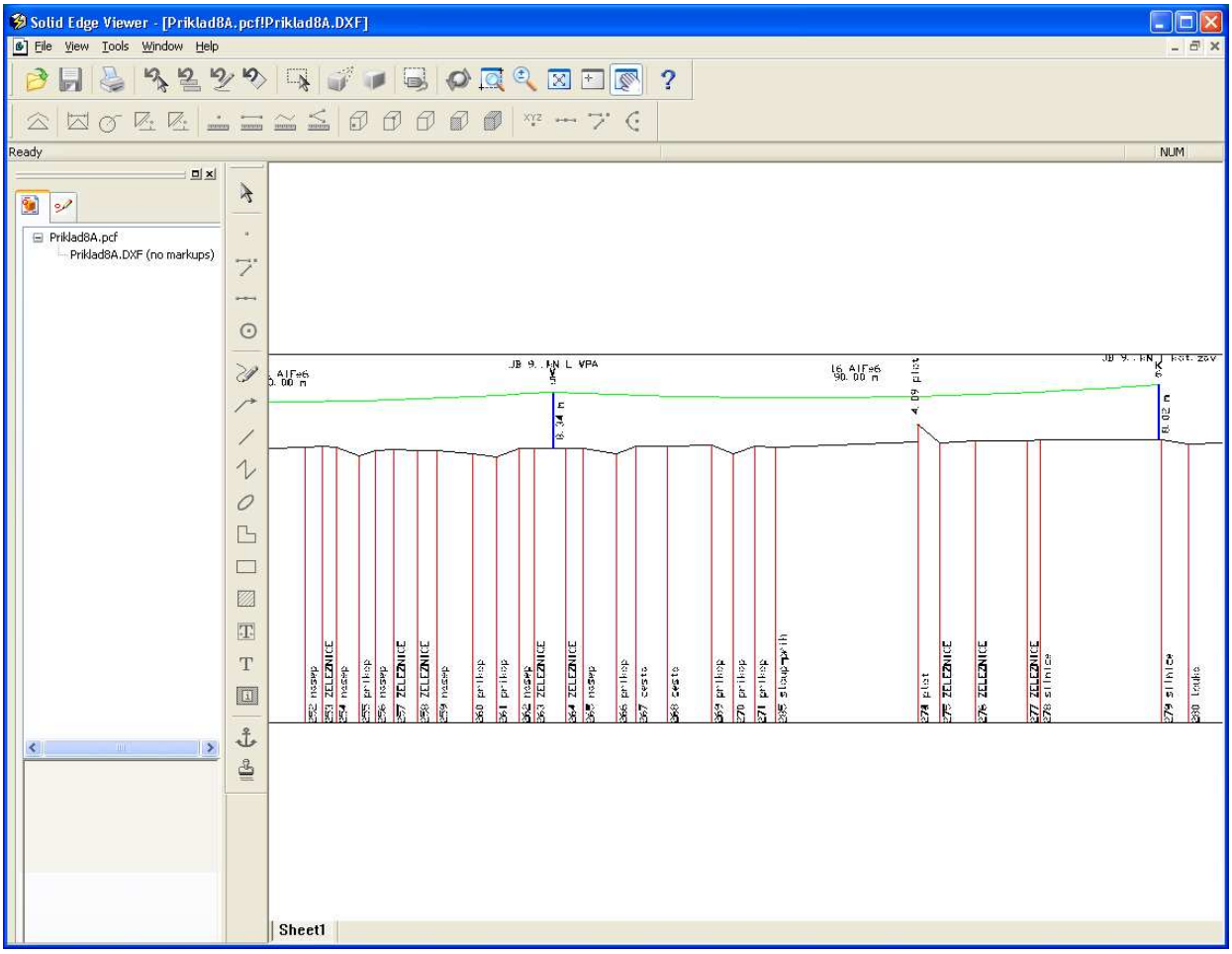
```
80              34.599          3.3080          1018.2
-------------------------------------------------------------
-5 + N          110.00 !!!      2.2202          1517.1
-------------------------------------------------------------
```

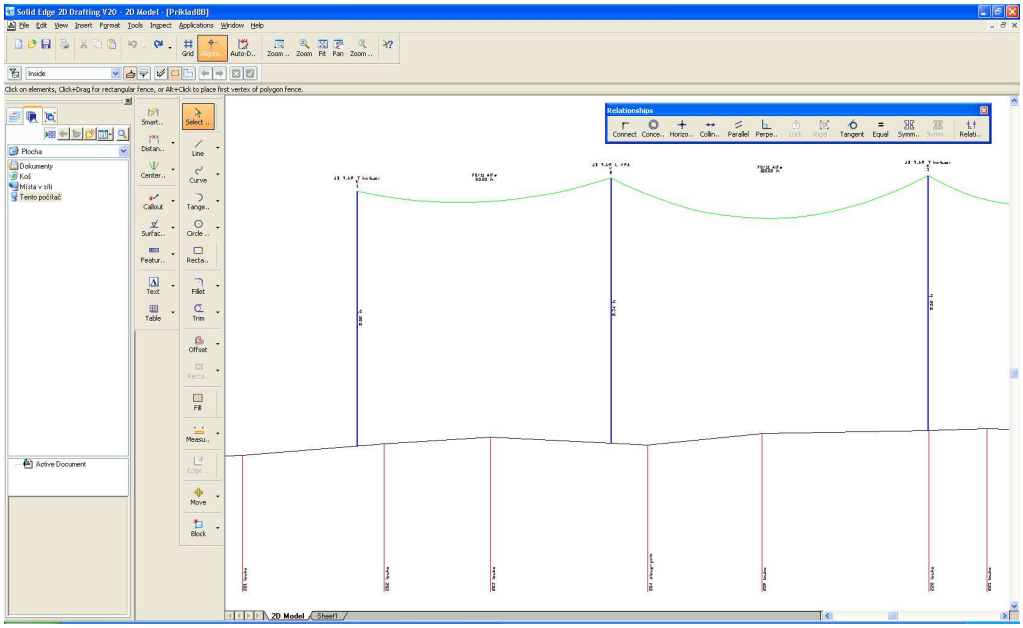
And of course also in installation tables are improper values recognizable:

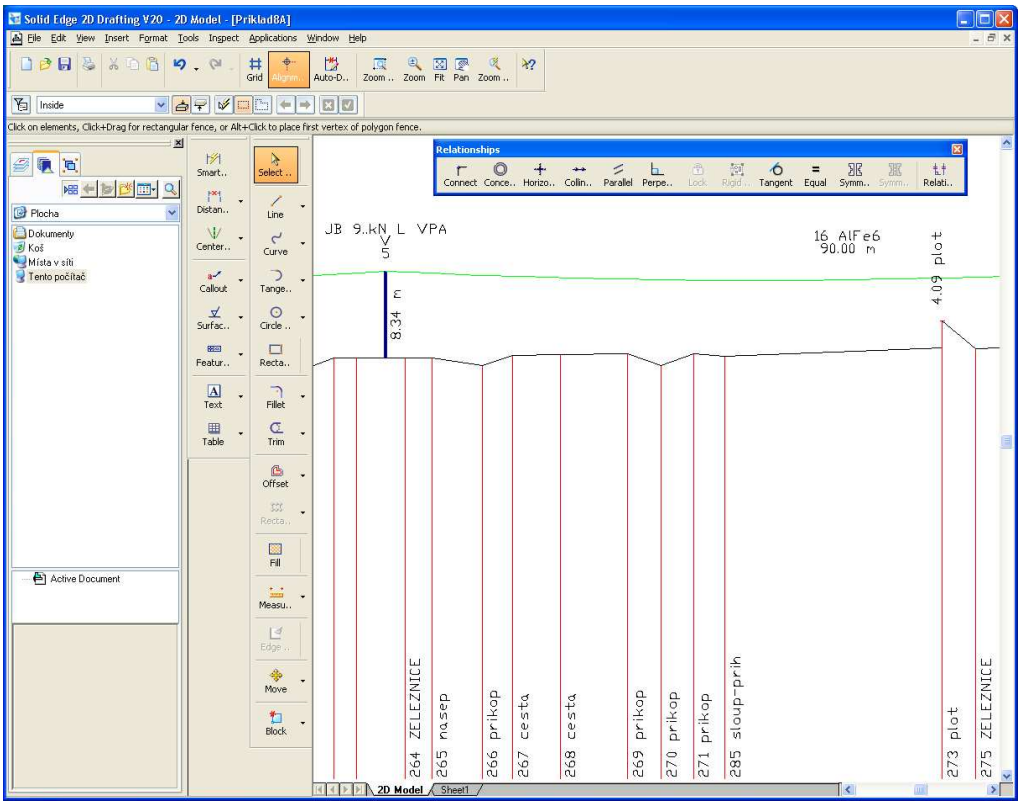
Namáhání vodiče [MPa] Vodič: 70/11 AlFe

Rozpětí/Teplota	-30	-20	-10	0	10	20	30	40	50	60	70	80	-5+N
70 m	139.4	125.6	111.9	98.31	84.92	71.88	59.44	48.04	38.32	30.78	25.37	21.59	110
75 m	138.6	124.8	111.2	97.64	84.36	71.46	59.24	48.15	38.78	31.53	26.28	22.55	110
80 m	137.7	124	110.4	96.93	83.76	71.02	59.03	48.25	39.23	32.25	27.15	23.47	110

Finally application can create export of line layout for CAD (for example AutoDesk AutoCAD, Bentley Microstation and even some free CAD systems and viewers) in DXF format. This is very suitable to use this feature for easy project documentation making. Exported line and terrain data in Solid Edge tools show next pictures:







4. CONCLUSION

New application for line design makes construction, verification calculation, project documentation and installation data table creating easier and faster. Beside that it reduces possible mistakes in respecting all new standards.

5. REFERENCES AND BIBLIOGRAPHY

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Authors' Address

Doc. Ing. Karel Noháč, Ph.D., Ing. Lucie Noháčová Ph.D.

University of West Bohemia in Pilsen, Faculty of Electrical Engineering, Department of Electric Power Engineering and Ecology
Establishment: Univerzitní 26, 306 14, Plzeň, Czech Republic

Tel: + 420 377634301 Fax: + 420 377634302
E-mail: nohac@kee.zcu.cz Tel: + 420 377634343
nohacova@kee.zcu.cz Tel: + 420 377634358