

Online calculating stability and safety against fracture of trees

The online calculation program TSE

With the computer program Tree Stability Evaluation you can make your own calculations for the stability and safety against fracture of trees based on the tensile test in accordance with WESSOLLY. All users are requested to contribute to optimizing the program.

In the last 20 years the development of intensive examination procedures has created a multitude of various devices and methods, many of which have stood the test in tree safety examinations. The research group on examination equipment of the *Fachverband Geprüfter Baumpfleger e.V.* [German incorporated professional association of certified tree surgeons] has carefully examined and assessed ten trees in a practice test, using all common technical examination devices. After predicting the respective stability and safety against fractures the trees were pulled over until they broke down. By this, measuring values could be captured prior to and at breakdown following the classic material testing measures. By analysing such data it was possible to later make conclusions for their own accuracy of prediction. The result was that the measuring devices used showed a rather high accuracy regarding breakdown load and type of breakdown. With the tensile test method in accordance with WESSOLLY the breakdown load and type of breakdown could be predicted through a window of $\pm 10\%$.

Despite the excellent measuring values the tensile test is showing in thorough examinations, it nevertheless is rather alien to the majority of experts due to its complexity, and its results are hard to understand. Consequently it was necessary to turn the comprehensive calculation steps to evaluate the tensile test results into a user-friendly, easy to operate standard computer program. The computer program is based on the tree examination by a tensile test following WESSOLLY. By means of pulling equipment the expert introduces a certain force moment in the tree, simulating a wind load. Due to this force the trunk is bent, the root plate is tilted. High-resolution measuring devices (Resolution: $1/100^\circ$ or $1/1000$ mm) record the trunk's edge fibre strain and the root plate's

tilting. The top point of attack is determined by means of a particular program calculating the top sail surface and its load centre.

After entering the collected data in the TSE program user establishes necessary assumed values such as oscillation willingness, turbulence situation (nozzle effects), wind force and others. By means of such theoretical load parameters the TSE program calculates the values for stability and safety against fracture of the respective tree. The use of the tensile test receives a clear, reproducible result for stability and safety against fracture in the static case.

Trend: Comprehensive approach to the tree safety check

With Tree Stability Evaluation the tensile test was transformed into a computer program that is easy to understand for experts. Thus, this prognosis of stability and safety against fractures for trees may complement other common procedures for thorough examinations as well. After all, the research group on examination equipment has found in its practice test that best results may be achieved in tree safety checks by effectively combining common visual and technical analysis methods such as the tensile test following WESSOLLY and SINN, VTA/MATTHECK and others. Conclusion: Future development of tree safety checks is moving towards an integral examination combining a lot of information of both a visual and technical nature in a comprehensive result.

In order to promote such approach in the professional public the initiative "Independent Tree Expert Group" (ITEG) was brought into being. Its goal is professionally executing integral tree safety checks by means of state-of-the-art methods in compliance with rules and standards and following a uniform process. It is planned to offer appropriate training measures on correct use of all common methods and processes for interested professionals. Within such scope it is also intended to offer training on using the computer program Tree Stability Evaluation.

As of yet, Tree Stability Evaluation is intended for training purposes only. Like in a permanent workshop all concerned experts are requested to contribute to optimizing the program. All together the users are able to improve the computer program's contents: By entering the measuring data obtained by them and pointing out potential weaknesses they contribute to refining the program bit by bit.

Hitherto feedback on the computer program Tree Stability Evaluation and establishment of Independent Tree Expert Group is consistently positive. Experts from Germany, Austria, Italy and Spain already signalized their interest. A first meeting of Independent Tree Expert Group will be scheduled for March 2011. You can find more information on the training version of the computer program Tree Stability Evaluation and on the Independent Tree Expert at www.die-nuernberger.info. Interested professional users can register at that site and automatically are granted access to the online program.