Users Guide for the program ConWall.exe

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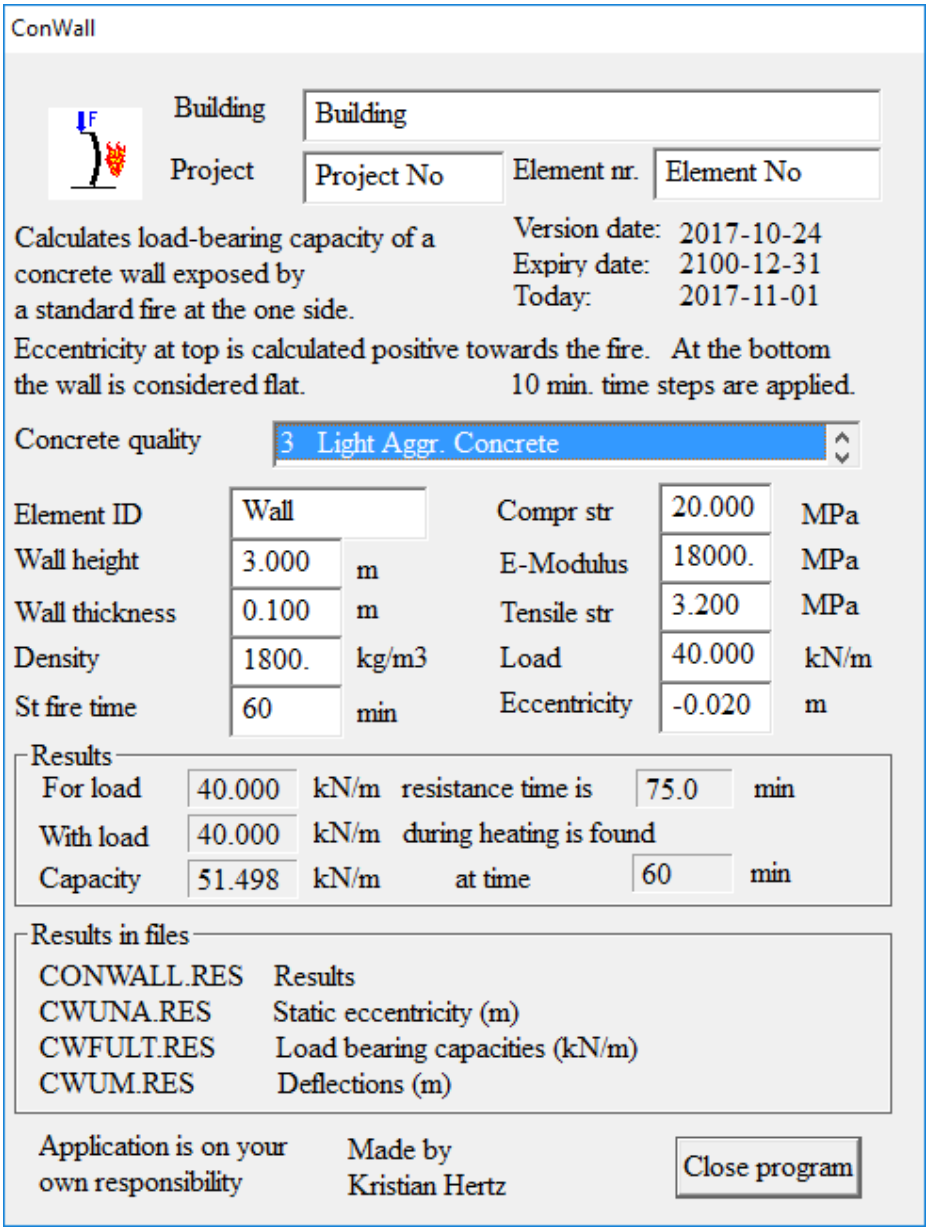

Notice! You have to choose a concrete quality to run the program.

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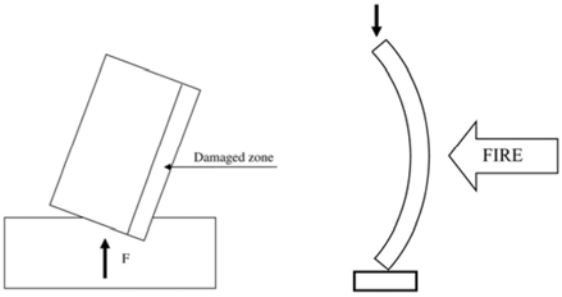
Preface

The program ConWall is designed to calculate the load-bearing capacity of an eccentrically loaded concrete wall exposed to a standard fire on the one side.
The program calculates in time steps of 10 minutes temperatures, transient deformations, and damages of 10 lamellas through the wall. From that the program determines thickness of the damaged zone and the deflection of the wall for each time step, and based on that it calculates the total eccentricity and the load-bearing capacity.
From these calculations the fire resistance time for the applied load is found.

The program is developed and improved based on previous Danish versions like LKVaegW and LKBW made in 2003 for the Danish light-aggregate concrete industry. These original versions were limited to application for walls of concrete of density between 600 kg/m^3 and 1800 kg/m^3, where the present program does not have this limitation.

Responsibility

The user has the total responsibility for the application of the program and neither programmer nor distributing organizations can be held responsible for use or installation of the program.



What does the program do?

The program calculates the load-bearing capacity in kN/m of an eccentrically loaded wall exposed to a standard fire according to ISO 834 on the one side.
The applied load and eccentricity e is given in m at the top calculated as positive towards the fire exposed surface.
The wall is divided into 10 lamellas, and in time steps of 10 minutes the program calculates in each lamella the temperature based on a conductivity derived from the density of the concrete.
For each time step the transient stress and strain of each lamella is found, and from that the transient deflection and the actual load eccentricity of the reduced cross-section is found. Based on these values the load-bearing capacity is found.
For the entire development of the load-bearing capacities, the fire resistance time is found as the time, where the capacity is equal to the load.
Notice that the intended load is needed in order to calculate the stresses and thereby the transient strain in each lamella at its temperature level.
The wall is considered supported on a flat bearing at the bottom. This means that at each time step an eccentricity is introduced from the transient thermal and statical curvature forcing the wall to be supported on an edge usually towards the fire.
For design purposes you should apply the smallest load-bearing capacity that can be found for the maximum and minimum eccentricity, which may occur.

Result files

The calculation result is shown in the window. In addition, the same and more results are written into ASCII files in the same directory as where the program is found. They are overwritten next time you change a value. But by changing the name of a file, you may keep it as documentation. For the same reason you can name your project and wall etc., so that it is written in the result file.

CONWALL.RES	Saves a little more than the information at the screen.
CWULT.RES	Development of load-bearing capacity from 0 to 240 min.
CWUM.RES	Deflection of the wall from 0 to 240 min.
CWUNA.RES	Internal eccentricity from 0 to 240 min.

Installation of the program

The program file ConWall.exe of only 785 kB is all that you need. This file is placed in a folder on a Windows based computer, where you want to run the calculations.
When the program runs ASCII files are written in the same folder containing the results for information and documentation.
Next time the program runs it overwrites these files.
You may place copies of the program in different folders, and you may even run these copies simultaneously. By means of that you can compare results of different in-data directly from the program windows on your screen.
Most computers do not allow you to mail an -.exe file.
To avoid such problems the name may be altered to ConWall.exy.
If so, change the “y” to “e” in the file name, when you install the program on your computer. You can do that for example by right clicking the name in Windows Explorer and chose the option Rename.
The program has an expiration date shown in the window.
From this date it will no longer run, and a new version should be required.
This is done especially in the phase of development in order to avoid that old versions with possible errors are applied, which may compromise its credibility.

How to apply the program

The program is found in the file ConWall.exe.
When you double click the file in Windows, a new window is opened with a simple user interface, and a calculation is made with some preset parameters.
At first you have to chose a Concrete quality by clicking on your choice in the box for this parameter.
You may then change the other parameters by clicking on them in their boxes and entering new numbers.
This is not a commercial program, and it is not safe for unintended use.
This means that it may close, if something impossible is entered.
Especially, you have to apply a period . and not a comma , for decimal numbers.
This means that you should write: 7.34 and not: 7,34!
Results are presented in the same way (English notation).

Conditions and limitations for the program
The wall is exposed to fire on one side.
A flat bottom side is supported on a plane surface.
This support is usual for the applications.
In case of fire the wall curves towards the fire and the bottom side will tip.
By that you can expect a minor crushing of the edge of the reduced cross-section towards the fire giving rise to a new eccentricity at the bottom.
The program calculates only for a standard fire without cooling phase.
For fully developed fires you should take into account that the strength parameters of concrete is reduced further during the cooling phase. This is often taken into account by application of a safe-side estimation of the required standard fire resistance time.

References
K.Hertz: Documentation for calculations of standard fire resistance of slabs and walls of light aggregate concrete. BYG.DTU R-48. November 2002. 43p.

You may download the report from www.byg.dtu.dk
It describes the calculation method and examples are calculated and compared with full-scale tests. The calculations of the report are made by a previous version of the program in MathCAD, and the results are close to those of the program.
The report therefore serves as a documentation for previous versions of the program LKBVaegW and LKBW and thereby also for the present program.

K.Hertz: Fire resistance of concrete walls with light aggregate. 15p.
This journal paper is submitted November 2017 for
Journal of Structural Fire Engineering.

The paper contains a derivation of the formulas applied for the calculations of the stability of eccentric loaded columns and walls.
In addition it compares calculation results of the present version of the program with results of full-scale tests, and it therefore serves as a further documentation for the program.