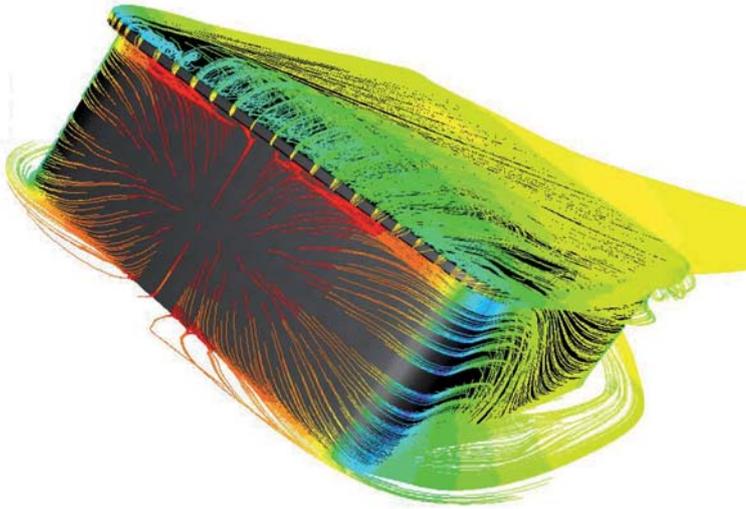


LKE--



AERODYNAMICS / FLOW SIMULATION

TASK

Identify the root cause of the polycarbonate window failure during the strong wind. The building stands in the area of frequent strong wind of one direction as shown in figure below.

In some cases the vacuum deforms the window panel so that it releases from holders and falls off.



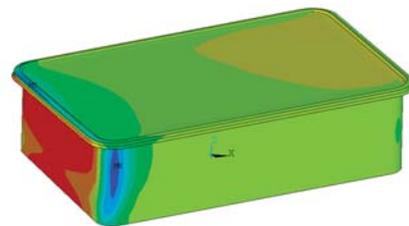
BENEFITS

- The cause of warranty repairs has been removed.
- Architect got solution for designing similar buildings.

APPROACH

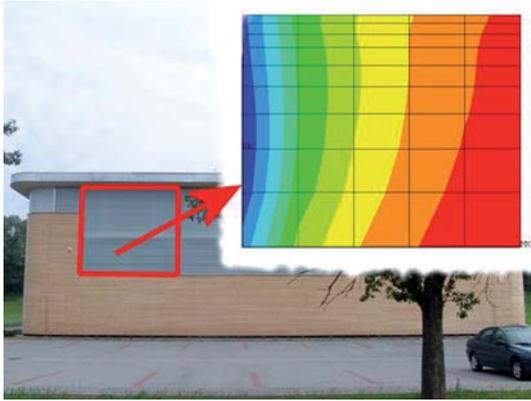
The analysis must first verify that the window failure is really caused by the wind flow and identify what flow direction causes the maximum vacuum at the window. Then the actions to prevent window failure are proposed.

Figures below show the wind speed around the building and air pressure distribution.

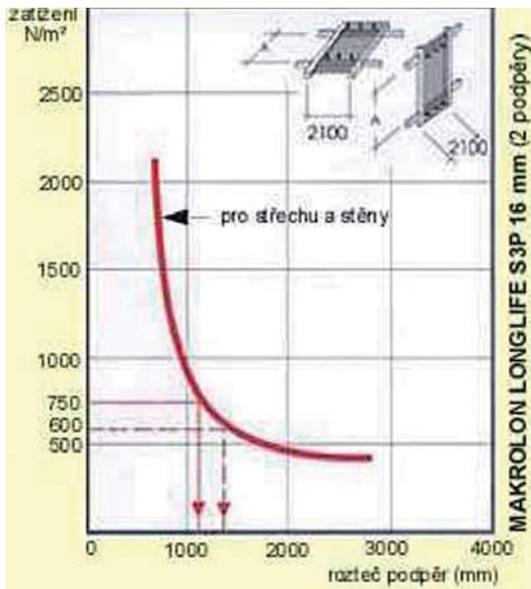


The first results of the flow analysis showed that the vacuum could cause the problem with the window failure.

Therefore the next steps investigated whether the vacuum may lead to the window panel holders deformation and failure. Figure below shows detail of pressure distribution on the panel.



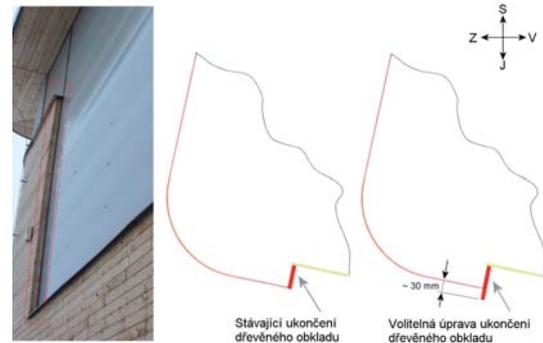
Although the value of the vacuum isn't any high, due to the window large surface the resulting force is significant. However even such force can't break the metal holders. Thus the investigation turned on the polycarbonate panel itself. The mechanical properties of the panel were found and its deformation due to vacuum was analyzed.



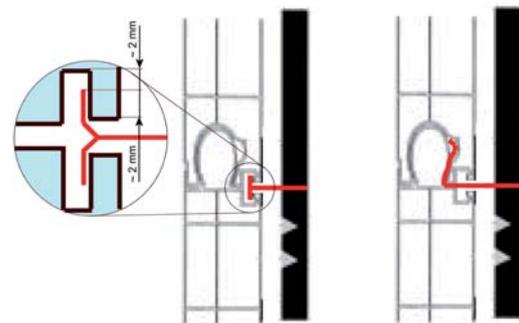
As is shown in figure above, the panel deformation due to the vacuum is so large that the metal holders aren't wide enough to keep the panel in place and thus the window panel falls off.

SOLUTION

Based on the investigation two options were proposed. The first was design change of the building corner which would change the wind flow and reduce the vacuum.



Second option was design change of the metal holders so it will work even for large deformation of the window panel.



RESULT

The performed analyses identified the root cause of the problem and supported the solution proposal. The option with metal holders design change was chosen since it keeps the building architecture unaffected.