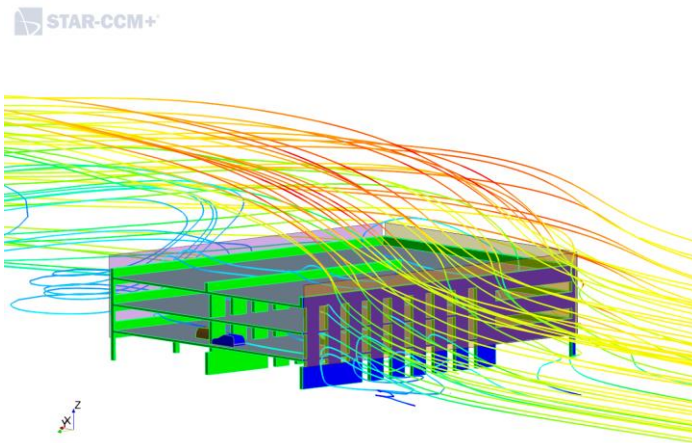
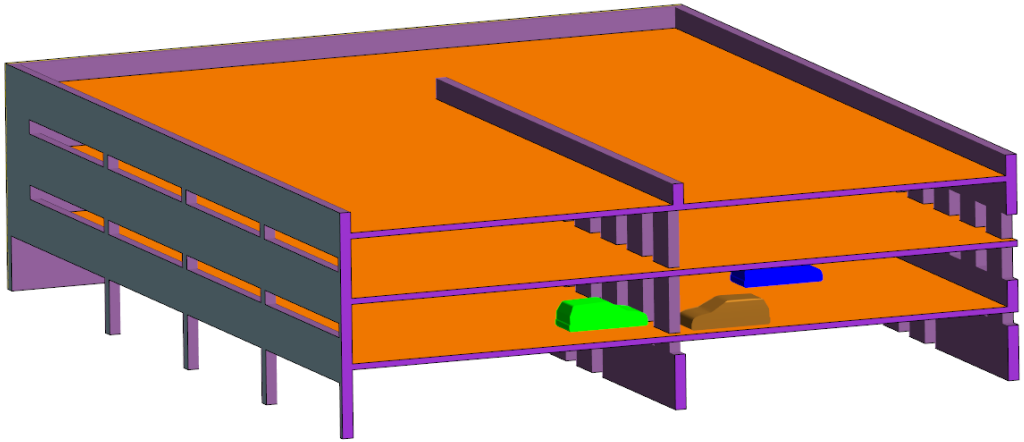
CFD Flow Simulation of Airflow Around and Through Parking Garage Structure

This study evaluated the airflow through a newly built parking garage structure using computational fluid dynamics (CFD). The parking garage was designed with a decorative screen surrounding the structure to enhance architectural appeal. The screen consisted of thin pieces of sheet metal with thru holes of various sizes that created images on the exterior side of the parking garage. A concern was raised that the screen may impede air flow through the parking garage and not meet local building code requirements. Local building codes had specified a minimal percentage opening that all parking structures had to have per floor. Although the base design of the structure in question had larger openings per floor than those required by local building codes, the client requested that Predictive Engineering run CFD analysis to demonstrate that airflow through the parking garage with the surrounding screen design still meet the intent of local building requirements.

Predictive Engineering created a simplified, symmetric, model of the parking garage design and simulated 2 cases, **Error! Reference source not found.**. The first case was a baseline design that removed the surrounding screen and reduced the side openings down to minimal building requirements. The second case analyzed the current design of the parking garage with full size openings and surrounding screen. The thin screen was analyzed as porous baffle surrounding the structure. The comparison of these two case studies was provided to the client to demonstrate the impact of the screen in comparison to local building code regulations.

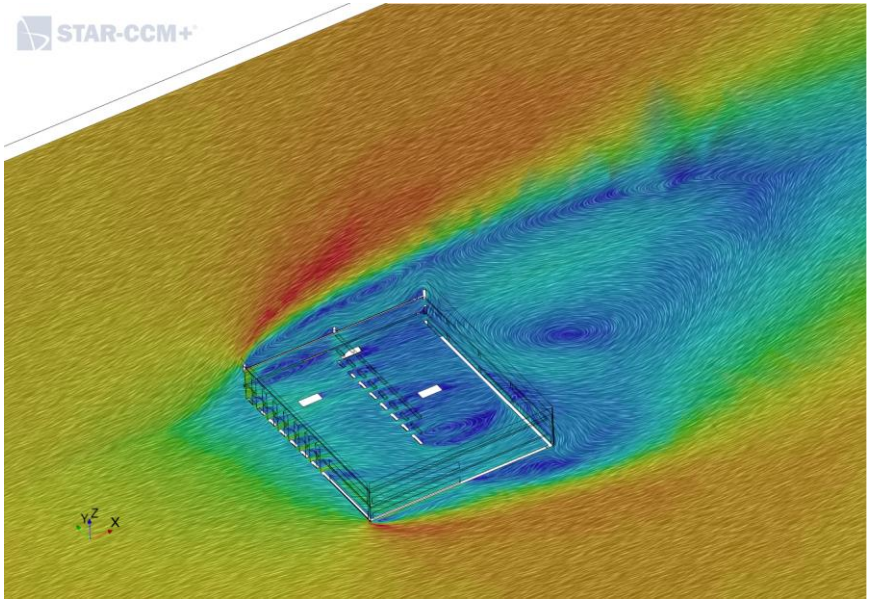
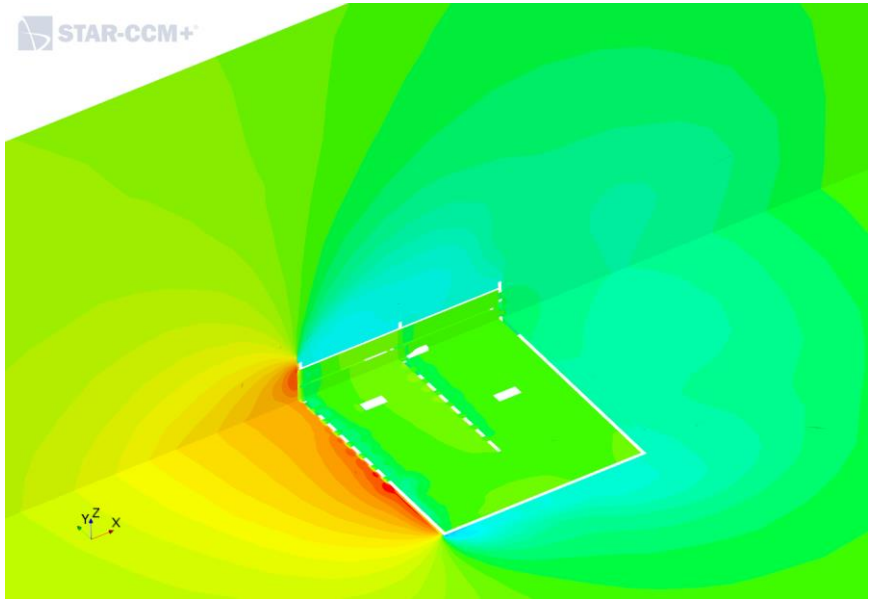
What We Studied





Simplified model of parking structure

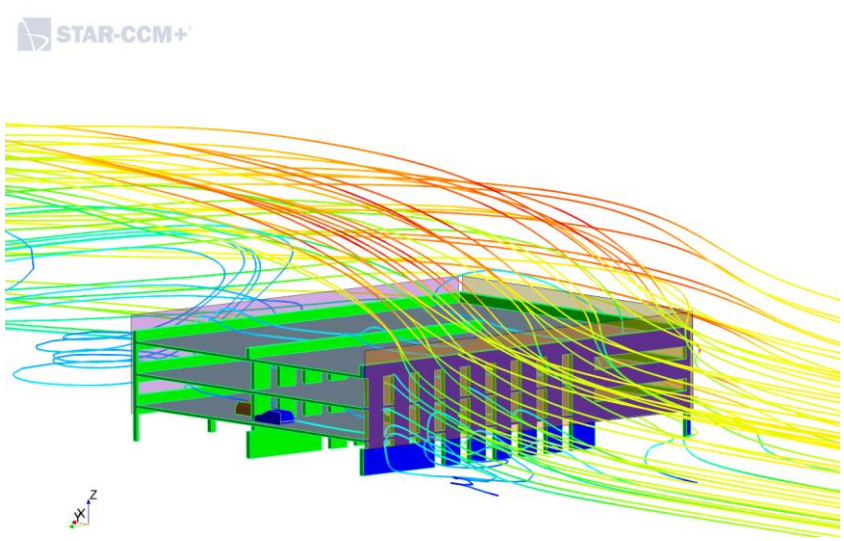
Flow Velocity Profiles Around Parking Structure

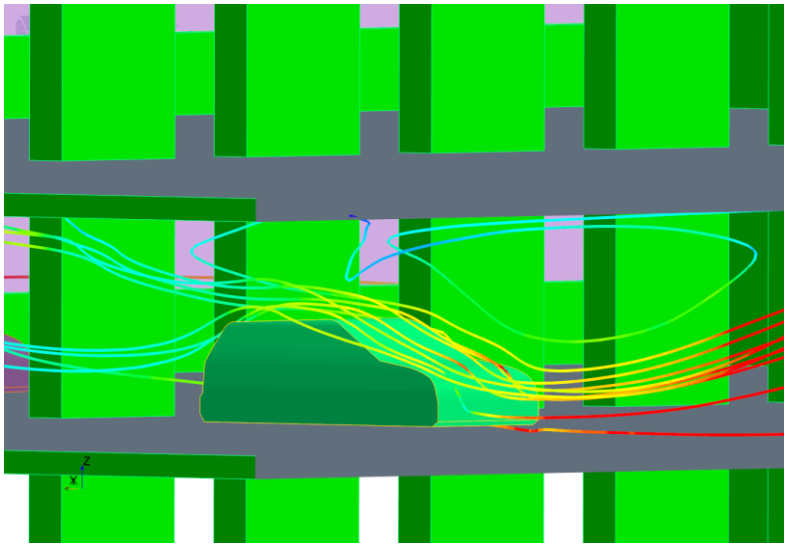
Section Vector Plots	Section Pressure Profile
	

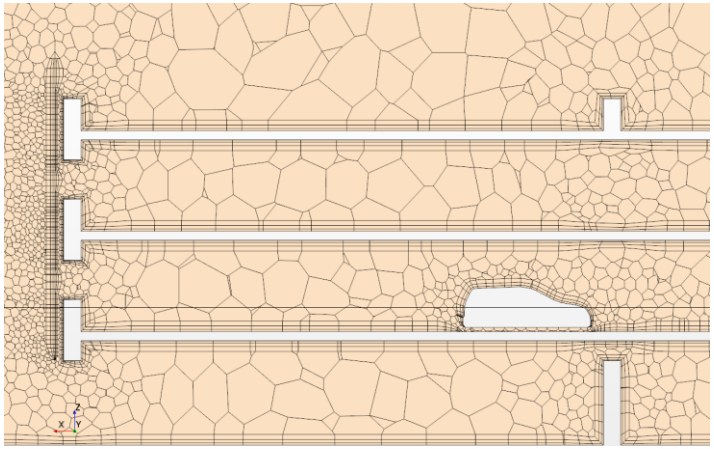
General wind charts were checked to determine what would be nominal wind speeds and directions around the garage. After some discussion with the client, a series of CFD simulations were conducted to ensure that we have mapped the complete range of possible flow behaviors through the garage.

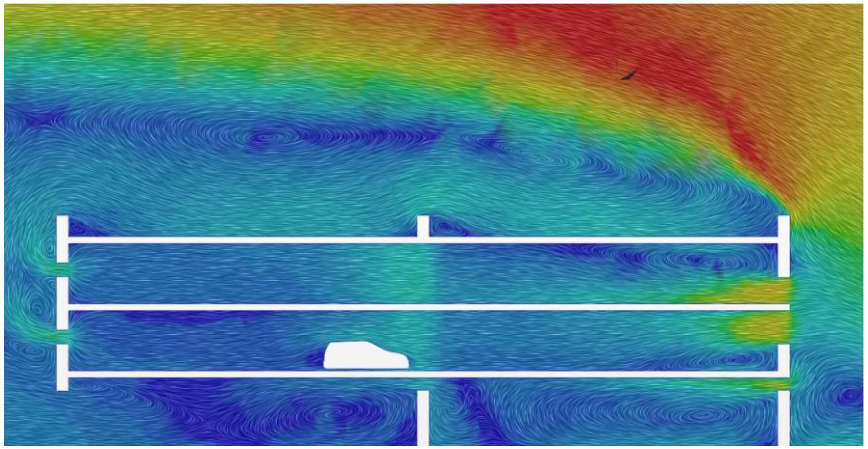
Streamline Velocity Profiles Around and Through Parking Garage

VELOCITY STREAMLINES AROUND PARKING STRUCTURE	STREAMLINES THROUGH STRUCTURE





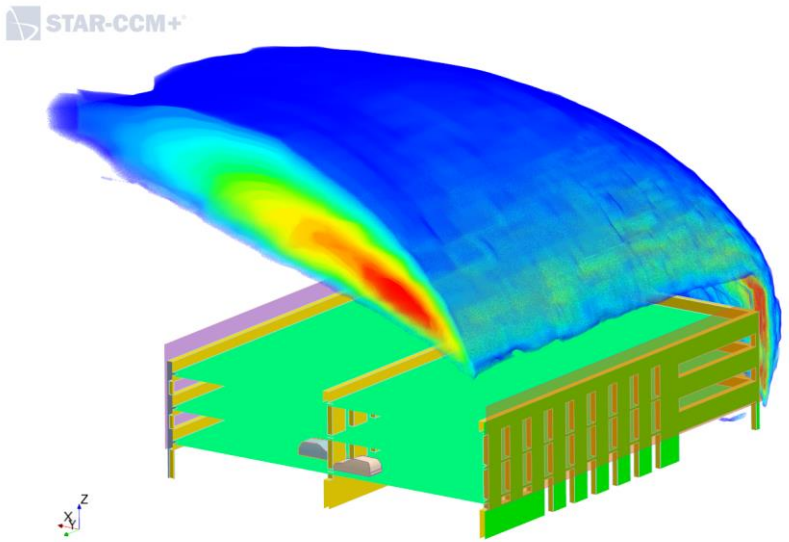


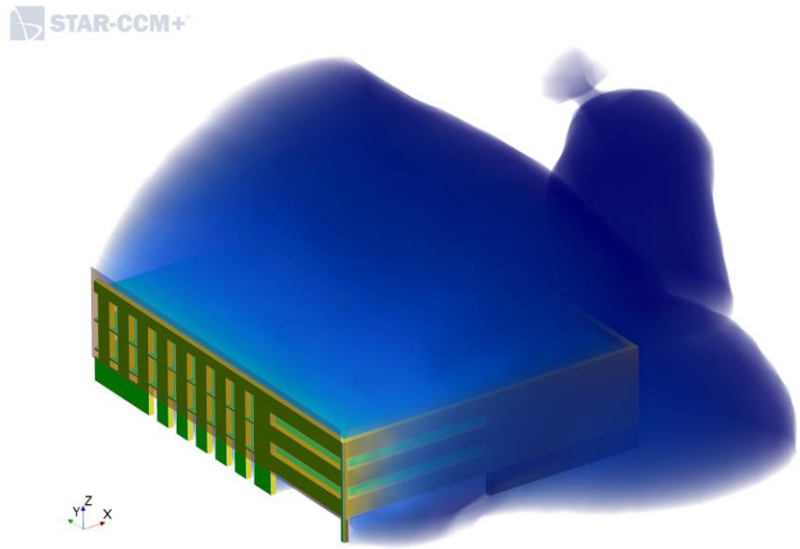


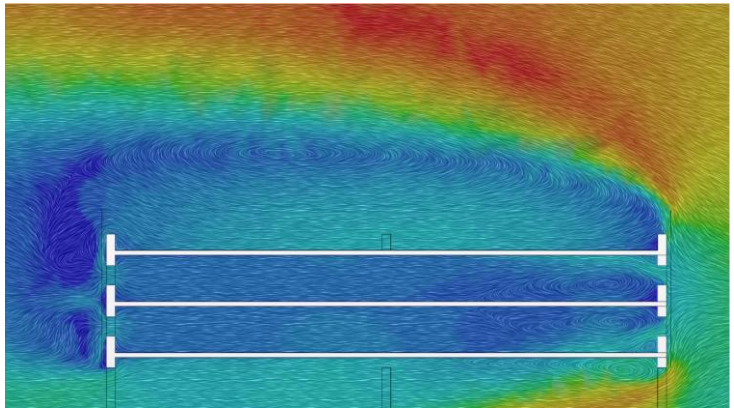
Flow tracing through and around the structure was very useful in understanding the flow dynamics of the wind as it hit the outside façade of the building and then moved through the floors of the structure. Several mesh refinements were performed to ensure that we had reached a stable flow regime.

Streamline Velocity Profiles Around and Through Parking Garage

Increased Velocity Regions Above Structure	Low Pressure Region Around Structure







As part of our effort, we looked at ways to improve the airflow around the building to increase through flow ventilation. Velocity and pressure plots were created and discussions were held about opening up certain sections to decrease pressure buildup. Upon final recommendation, it was determined that the structure could meet the cross ventilation requirements with no additional changes.