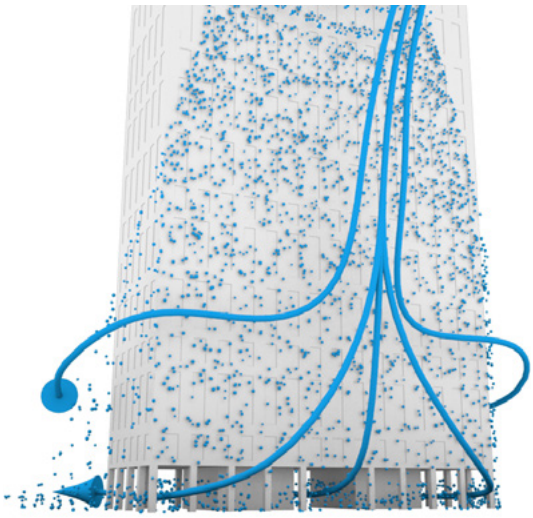
WIND-DRIVEN RAIN

Managing rain accumulation and keeping open spaces dry through thoughtful design



Wind and rain may interact with a building's form to cause rainwater to move and accumulate in unexpected ways. Good design for open spaces and rainwater management takes these patterns into account.

Open spaces

A growing trend favors naturally ventilated public spaces, especially in warmer climates. This trend is driving architectural designs to be more open to the environment. Such spaces benefit from natural light, fresh air and overall higher user satisfaction.

However, such spaces are also more exposed to the elements. The wind can carry rain into exposed areas, sometimes in unexpected ways. And architecture can worsen the problem by shaping unfavorable airflows.

The results can be unpleasant, costly, or dangerous. Patrons get damp and annoyed; floors get dangerously slippery; electrical circuitry is exposed to water. Whatever the effect, the overall usability of the space is compromised. The good news is that carefully placed adjustments can prevent most of these effects.

Rainwater management

Wind–rain interactions can affect drainage systems, rainwater harvesting systems, cladding systems and roof loads. Depending on the local climate, smart tweaks to your building's orientation and form could make a big difference to your capital and operating costs for managing rain and its effects.

Our Service

We show you where rain will go, how often it will go there, and how to make it go somewhere else—without creating new issues. We look for holistic solutions to make sure your design works well rain or shine. Often we're able to provide early feedback using simple calculations, but for novel designs we can perform full-scale tests to ensure accuracy.

We first create a physical picture of how rain could enter ("infiltrate") your project, working with the specifics of your location and design. To do this, we apply our world-leading expertise in meteorology, fluid dynamics and the physics of airborne particles. Depending on your needs and the possible issues, we will simulate airflow and raindrop travel to quantify infiltration problems. In addition, we may do physical simulations in our wind tunnels.

We test our proposed solutions in the same simulations, and we seek advice of colleagues throughout the company to make sure the changes don't cause new problems elsewhere. For example, our wind engineers can make sure a bus shelter won't create unpleasant new winds for nearby pedestrians. We can also do calculations for guttering and runoff based on the same high-quality meteorological statistics.

The results are presented in terms of risks, so you can make informed decisions about solutions and tradeoffs.

RWDI is a valuable partner to clients seeking to...

Explore Innovations

- Use a novel design or new façade system without creating rainwater issues
- Implement effective naturally ventilated structures
- Implement a "right-sized" stormwater retention system for an effective green building

Create Opportunities

- Provide pleasant outdoor spaces that patrons and residents enjoy in all weathers
- Minimize rain management costs with good siting and design

Meet Challenges

- Find precisely targeted and effective fixes for infiltrating rain
- Protect intakes for sensitive equipment

Fulfill Expectations

- Keep patrons dry in open sports and music venues and shopping areas
- Comply with code requirements for guttering and runoff calculations, especially for complex façades

How we work

Climate analysis

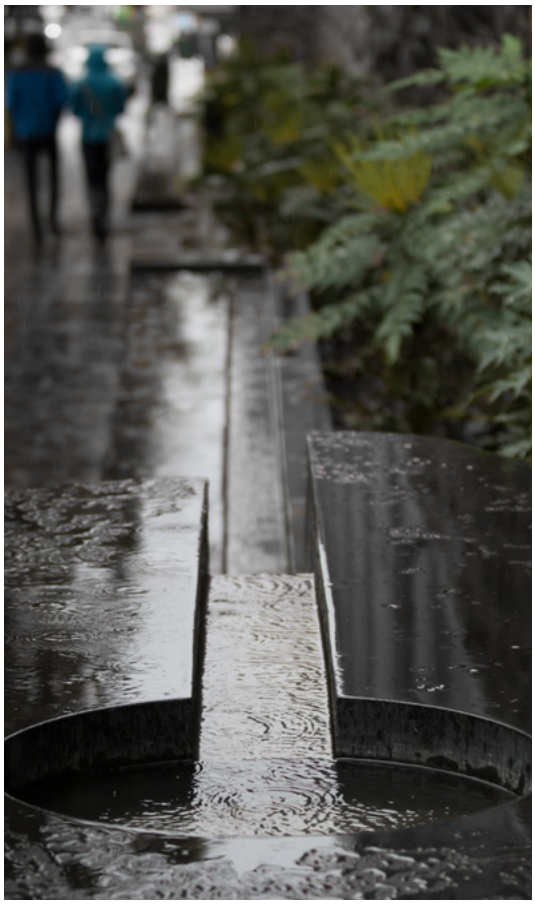
All projects begin with an analysis of wind and rain patterns at the site. From this we gauge the frequencies, intensities and durations of rain events (both typical and extreme) and the prevailing wind directions and speeds in these events. We are world leaders in developing high-quality, locally accurate statistics for wind and rain events. We estimate the risk of rain infiltration on the basis of this climate analysis, the building massing, and the physics of droplet trajectories.

Airflow modeling

If it looks like rain penetration could be a concern, we can make a computational fluid dynamics (CFD) model of the site and surrounding environment. We'll use this to simulate the wind direction(s) and speed(s) of interest. In these simulations, we account for how the local built and natural environments will affect airflows. We also look at the effects of proposed mitigation measures. If we've worked in your area before, we leverage our existing CFD models.

Rain modeling

We can simulate rain as individual moving particles. We start with a cloud of spherical particles that are sized to average raindrop diameters. The model tracks each particle as it moves through the site under the influence of gravity, drag and the airflows simulated previously. The distribution of particles on surfaces of interest is used to determine the relative "wetness" of those surfaces.



We can adjust droplet diameters to represent different rain events and develop a wetness scale or ratio.

Climatic wind tunnel testing

In certain cases, especially for novel façade forms or materials, we may test physical models in a climatic wind tunnels to gather more precise data. These are specially designed environmental chambers that can simulate many kinds of environmental conditions, including wind, rain, snow and ice. They are used to investigate how conditions affect a test section of façade.