# MASTERPLANNING SIMULATIONS AND CONSULTING

Supporting holistic planning through scientific definition of context and likely performance

Masterplanning is one of the earliest steps in designing any new building, campus, neighborhood or city. A masterplan presents the overall characteristics of a development. It locates building types (e.g., residential) and their relative locations and specifies street layouts and placement of parks and green spaces.

Most masterplans also include infrastructure layouts that require energy demand, renewable energy strategies, public transit, water and other sustainability measures to be reviewed, calculated and accommodated.

A good masterplan sets the framework for vibrant development, leading to increased economic activity, more efficient energy use, reduced pollution and better health. The arrangement of streets and buildings each contribute to the betterment of other aspects of the design.

A flawed masterplan can sabotage all subsequent architectural design in the plan area. For example, poor massing of buildings may preclude effective natural ventilation or daylighting. In this situation, it may be difficult—or even impossible—to create a comfortable, efficient set of buildings and spaces.

## Our service

We help you ground your masterplanning effort in the best scientific data and engineering judgment.

We are experts in how climate affects buildings and the spaces around them, and we have the data and computational resources to back up our conclusions and recommendations. In particular, we can quickly leverage deep computational resources early in the design process. We excel at rapid proof-of-concept testing—giving you freedom to innovate.

We use custom software to simulate wind, sun, thermal comfort and energy efficiency throughout the design process. Our climate analysis and in-house climate datasets are second to none. And we excel at assessing energy consumption and potential sustainable energy production. With such analysis, you get an integrated energy picture.

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We bring an integrated team of in-house specialists to the table in workshops and early design meetings. In such meetings, these highly knowledgeable consultants can provide fast, on-the-ground advice, drawing on past experience and quick calculations.

As design proceeds, we provide continual, detailed input to the design team on issues such as:

- Improving pedestrian thermal and wind comfort
- Reduction of heat island
- Means to reduce energy demand
- Energy generation potential
- Preventing adverse exhaust re-entry/re-entrainment
- Creating a pleasing acoustic, noise and vibration environment
- Other environmental factors including water and waste reductions.

With this input, your team can make early design decisions that create a resilient, climate-responsive masterplan.

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

**Explore Innovations**

- Pursue visionary masterplans with confidence in their real-world performance once built
- Persuade stakeholders by presenting a scientific case for ambitious concepts for low-energy cities, walkability and other concepts

**Create Opportunities**

- Create popular, functional masterplanned areas that serve intended users effectively
- Generate additional revenue potential through more comfortable outdoor spaces

**Meet Challenges**

- Create masterplans that foster usable, comfortable environments even in challenging climates and conditions
- Accommodate diverse perspectives, needs and design disciplines within a unified masterplanning process

**Fulfill Expectations**

- Provide all users, occupants and residents with the experience they expect from the planned area

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## How we work

A successful masterplan supports the creation of an efficient, comfortable and vibrant place. A critical part of achieving this goal is ensuring that the masterplan is responsive to local climate and surrounding.

Thus, our work centers on understanding how climate impacts the design. We give particular attention to improving pedestrians' experience of wind and thermal comfort.

We first give qualitative advice on early concepts. Then, as the design starts to take shape, we will simulate wind and sun conditions throughout the site for every hour of the year. Through this analysis, we can help you reduce building energy consumption by advising on appropriate passive design strategies.

We have developed several proprietary computational tools for evaluating the climate responsiveness of masterplans:

- VirtualWind™, for wind simulation
- Eclipse, for solar simulation
- Oasis, for thermal comfort (wind and solar simulations combined with a climate file)

The simulations are often very large and require the use of computer clusters that consist of hundreds of processors working in parallel. The results provide an in-depth understanding of solar and wind conditions within the development. We also combine these results with the local climate data files to create a set of performance metrics.

## Effective Masterplanning

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| **Energy Consumption** | Reduction of energy consumption and integration of energy control measures through inclusion of measures to support passive design (e.g. natural ventilation, daylighting). |
| **Renewable Energy Sytems** | Integration of site-specific renewable energy systems into masterplan. |
| **Transportation, walkability and use of space** | Optimization of thermal comfort within the masterplan, thereby reducing impact of excessively hot or cold weather conditions. Particular focus is given to walking and cycling routes. |
| **Air Quality** | Assessment and mitigation of sources of air pollution, such as road traffic, diesel generators and industrial stacks. |
| **Noise** | Reduction of noise pollution impacts, such as roadways and other equipment noise |
| **Economic vibrancy** | Creation of outdoor spaces that are comfortable, thereby increasing their revenue potential. Such spaces include:<br>• Cafes<br>• Performance spaces<br>• Amenities (e.g., ponds)<br>• Equipment rental |

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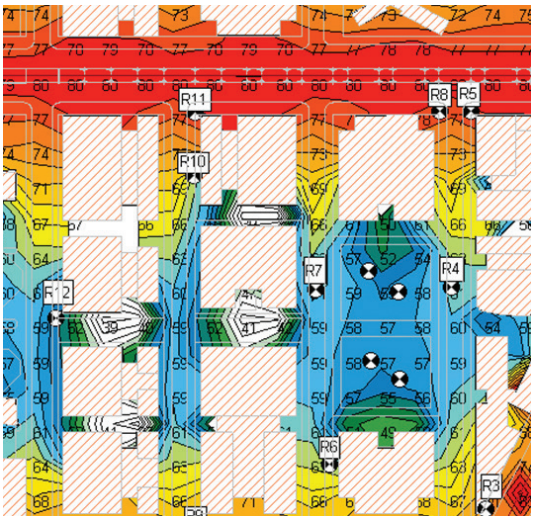


These metrics can be used to quantitatively assess the masterplan's performance. Such metrics include thermal comfort, natural ventilation, wind comfort and heat stress. The simulation results are also used in other studies, such as assessing exhaust re-entrainment, sand and dust transport, snow accumulation, solar glare and energy consumption and efficiency.

Wind and solar simulations are also often used to test concepts such as road alignments and massing choices. These simulations can be used to quickly "rate" the design concepts to support the design team's decision-making process.

We particularly encourage clients to think broadly about optimizing thermal comfort. The importance of this factor cannot be overstated for extreme climates, such as the Middle East or cold environments. Strategies that increase thermal comfort also increase walkability, which in turn improves street activation and, in consequence, economic viability and community engagement.

We can also model the energy consumption of the masterplan (e.g., for district heating/cooling). We create an energy profile that takes into account the climate, massing orientation, massing shape, gross floor area (GFA), floor-to-area ratio (FAR), energy conservation measures, façade properties and building occupancy schedules. For this analysis we use our proprietary masterplan energy profiler, which allows us to quickly assess a plan's energy footprint, hour by hour, over the full year. The tool generates hourly estimates of energy consumption. We can quickly change the listed input parameters to study their impact. We pair estimated consumption with options for renewable energy generation to create a holistic, optimized energy strategy.