



accu<sup>rate</sup>

Institute for crowd simulation

**simulate.  
visualize.  
improve.**

Planning of a museum's capacity, Architecnic Planungsgruppe, Felix Aries:

*"With the acquired knowledge, now there is a way to design the museums circuit from the perspective of the visitors' stream and the emergency case. In my opinion, this is a complete new approach for planning these kind of projects."*

Visitor simulation at FIFA Football museum, Roberto Petranca:

*"The simulation created a clear picture of the spatiotemporal connection between the three public floors, the shows and the DIY area."*

Evacuation analysis of Schloss Neuschwanstein, Ralf Gehrke:

*"The simulation has shown that we must change the walking routes of the guided groups for a fast evacuation."*

Evacuation simulation of Landshuter Hochzeit, Dr. Ernst Pöschl:

*"At the Landshuter Hochzeit, safety has now arrived in the 21st century."*

Our customers:



accurate.

## One of Germany's leading providers of crowd simulation.

Our mission is to optimise buildings, spaces and events for safety and functionality. We offer both consulting services and state-of-the-art software, **crowd:it**, to provide clients with actionable results they can trust.

Our work is centred around you. Our software, project work and customer support are the result of years of close collaboration with our clients who appreciate the focus we place on their needs.



Founders: Dr. Angelika Kneidl, Florian Sesser

## Our services. Your question is our passion.

### Your question is our starting point.

- We prototype and optimise buildings and events, so that your project functions as planned.
- We stress-test what-if scenarios, so that you can reduce risk.
- We refine operational procedures in the planning stage, so that your designs manage multiple use cases.
- We validate evacuation concepts, so that you can optimise and understand safety procedures.

### Our approach is iterative, and in close collaboration with you.

#### We provide:

- A deep understanding of crowd movement in your venue.
- Objective, reliable and targeted results
- Convincing and clear reports for all stakeholders.

**accu:rate** continues to actively research, working alongside Technische Universität München to maintain not only state-of-the-art software, but provide innovative solutions for our clients' complex problems.

With **accu:rate** you have a competent and passionate partner who speaks your language with experience and expertise.

Contact us – we can't wait to work with you in making the world a safer, more comfortable place.

Get in touch with us: [projects@accu-rate.de](mailto:projects@accu-rate.de) | +49 89 21 55 38 69

## Verticals and projects – How our service can support you.

### Our work answers many questions across multiple sectors:

- 1. CONSTRUCTION** 6  
Test architectural plans, with visitor flow analysis  
**Grand Tower Moscow:** Is this high-rise suitable for multiple purposes?

---

- 2. INFRASTRUCTURE** 8  
Stress-test stations and airports with passenger flow simulation  
**Deutsche Bahn:** Will the newly planned central station perform as expected?

---

- 3. EVENTS AND PUBLIC SPACES** 10  
Improve safety concepts with evacuation simulation  
**Oktoberfest Munich:** How should an evacuation of the fair unfold?

---

- 4. STADIUMS AND ARENAS** 12  
Generate and test multiple solutions once with crowd simulation  
**Rudolf-Harbig Stadium, Dresden:** Is the sports stadium suitable for a concert?

---

- 5. RETAIL** 14  
Understand your customers and optimise their experience with simulation  
**Telefónica O2:** How can customer satisfaction improve?

---

- 6. CULTURAL INSTITUTIONS** 16  
Optimise institutions for comfort and functionality with persona-based simulation  
**Humboldt Forum Berlin:** How does the museum cope with different types of visitors?

# 1 CONSTRUCTION

## Test architectural plans, with visitor flow analysis

Anticipating how people will move around your building is difficult. Looking out for problems in the planning stage can save money and time.

Crowd simulations enable you to test pedestrian movement in advance. From the everyday to an emergency evacuation, simulations provide a clear picture of how your venue will function. By utilizing new technologies such as Building Information Modelling (BIM), crowd simulation can deeply integrate into your planning procedures.

- How well does your building perform its role?
- Can people move around your building efficiently - in everyday situations and in emergencies?
- Is your building comfortable for all visitors?
- Will your building function at peak times?



## Grand Tower Moscow: Is this high-rise suitable for multiple purposes?

Planning a high-rise is one of the most demanding projects in real estate. Multi-purpose buildings must ensure high levels of service across numerous use-cases.

Werner Sobek Architects asked **accu:rate** to create a comfort study using pedestrian flow simulations.

### Initial questions of the architects:

- Will the planned high-rise be comfortable for all visitors, even at peak time?
- Where are critical points or areas with a lower level of service?



Picture: Werner Sobek Architects

### Scope:

- The three entry levels of the building
- ~20,000 people at morning rush hour
- One scenario: regular operations

### Results:

- Validation of the high-rise design.
- Proposals for layout improvements to enhance the level of service.
- Design approved for building permit.

## 2 INFRASTRUCTURE

### Stress-test stations and airports with passenger flow simulation

With a passenger simulation you can quickly verify whether your infrastructure performs according to your criteria, today and in the future.

- How many passengers can be handled in an hour?
- How much space is needed for queues?
- How can passengers' transfer times reduce?
- How can passengers' usage patterns be optimised?



### Munich Central Station (Deutsche Bahn): Will the newly planned central station perform as expected?



Munich's Central Station is to be renovated and extended with a new metro line. A new building complex will be forty meters underground, connecting railway, metro and overground transport.

**accu:rate** was commissioned by DB Netz AG to simulate the planned passenger flows at the station.

#### Initial questions of the planning engineers:

- Are the platforms suitably designed for the expected number of passengers?
- Do any bottlenecks occur in the building?
- How long are the transfer times between the six different train lines?
- How long does it take to evacuate the platforms in case of an emergency?

#### Scope:

- 7 levels connecting 4 metro lines, railway platforms, buses and trams
- ~6,000 passengers changing trains within 15 minutes
- Two scenarios: regular operation and evacuation

#### Results:

- Thorough insights into the performance of the station.
- Deep understanding of the transfer times between the different lines.
- Limits and improvements for the station.
- Reliable decision basis for refining the plan.



### 3 EVENTS AND PUBLIC SPACES

#### Improve safety concepts with evacuation simulation

Every event is different. The dynamics and interaction of thousands of visitors cannot be left to intuition alone.

Simulation provides quantitative data, which, alongside your expertise, provides compelling evidence for your decisions.

- How many visitors can attend an event safely?
- What is the best procedure for an evacuation, and how long does it take?
- Where are bottlenecks, and how can they be solved?
- What impacts visitor flow?



### Oktoberfest:

#### How should an evacuation of the world's biggest fair unfold?



The Munich Oktoberfest is the largest and most famous fair in the world – over six million visitors within two weeks. For such a major event modern safety management is essential.

**accu:rate** was asked to support Munich Security Services GmbH and the city of Munich in creating a feasible evacuation concept.

#### Initial questions of the safety planners:

- Does the evacuation concept function as proposed?
- How long does the overall evacuation take?
- Where do bottlenecks occur and for how long?

#### Scope:

- The whole festival area “Theresienwiese”, consisting of 16 beer-tents and over 500 stalls
- ~300,000 visitors – peak attendance on a Saturday afternoon
- Two scenarios: complete evacuation and partial evacuation

#### Results:

- Validated evacuation concept.
- Insights into critical areas, providing better preparation for security personnel onsite.
- Estimations for evacuation times per escape route.



## 4 STADIUMS AND ARENAS

### Generate and test multiple solutions once with crowd simulation

Stadiums and arenas are unique. All visitors arrive at the same time, carry out similar behaviours and leave at the same time. And with greater competition, stadiums, once exclusively used for sporting events now have a wide range of usages.

The intensity of such ingress and egress, as well as the behaviours during an event, lends itself to crowd simulation.

- Do ingress and egress times meet your requirements?
- What happens in case of an evacuation?
- Can the location of stands and shops be optimised?
- Is the stadium still safe when it is used for concerts?



## Rudolf-Harbig-Stadion:

### Is the sports stadium suitable for a concert?



The Rudolf-Harbig-Stadion is a modern stadium, built for over 32,000 guests, which is now utilised not only for sports, but for concerts.

To ensure safety, **accu:rate** was appointed by S&P Sahlmann to analyse the evacuation of a rock concert.

#### Initial questions of the safety planners:

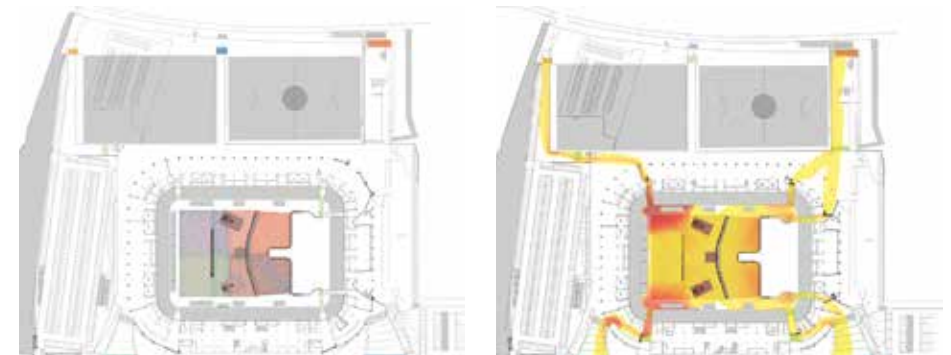
- Is the use of the stadium as an event venue safe, given the expected turnout?
- Where do congestions occur? For how long do congestions occur?
- What is the overall evacuation time?

#### Scope:

- The whole stadium, from infield to spectator stands
- ~30,000 rock concert spectators
- One scenario: a complete evacuation of the stadium

#### Results:

- An improved evacuation concept.
- Official permission granted for the event.



## 5 RETAIL

### Understand your customers and optimise their experience with customer flow analysis

Retail faces increased competition from online shopping. To stay attractive for the customers as well as for tenants and investors, revitalisation projects for shopping centres are now due every 10-15 years.

Simulations can help identify profitable locations for retailers, optimise the retail space and improve the customer journey.

- Does the shopping centre operate well - in everyday situations and in emergencies?
- Are there passive areas in which to extend the retail space, whilst maintaining safety?
- What happens to customer flow if shops move?
- What is the optimal layout for revitalization?



## Telefónica O2, shopping centre:

### How can customer satisfaction improve?



To analyse and understand how people move within a shopping centre, **accu:rate** collaborated with O2, Telefonica. WiFi data, provided by our partner, was imported directly into **crowd:it**, our simulation software.

These data facilitated a what-if analysis of the shopping centre, considering the effect of a stores relocation.

#### Initial questions of the operator:

- Can the customer journey be improved in the shopping centre?
- How do people move through the shopping centre? What are the main patterns?
- What areas are most frequented?

#### Scope:

- Three-floor shopping centre, including all shops
- ~1,700 shoppers during the two peak hours of a regular day
- Two scenarios: different store placements

#### Results:

- Analysis of hotspots and less frequented areas.
- Visualisation of visitor flow for negotiations with investors.





## 6 CULTURAL INSTITUTIONS

### Optimise institutions for comfort and functionality with persona-based simulation

A key focus for cultural institutions is that visitors enjoy their stay. Estimating visitor demands and their implications for the institution is often difficult.

Using visitor flow simulations, you can assess the visitor experience, with analysis that accords with your performance indicators.

- Are there enough basic amenities and are they accessible?
- Are the exhibits efficiently distributed?
- How do different groups, with different interests, move through the institution?
- Is the building large enough for the anticipated visitors?



## Humboldt Forum Berlin:

### How does the museum cope with different types of visitors?

Humboldt Forum, a cultural centre, lies in the heart of Berlin, providing exhibitions, cultural events and food spaces for its visitors.

In order to ensure customer satisfaction, the Humboldt Forum Foundation asked **accu:rate** to support their analysis of the visitor flow through six floors of attractions.

#### Initial questions of the owner:

- Is the Humboldt Forum designed such that all visitor groups enjoy their visit?
- Which types of visitor groups will be in the Humboldt Forum at the same time? How will they move through the building?
- Are the service facilities (wardrobe, restrooms, counters etc.) planned sufficiently for the expected number of visitors?

#### Scope:

- The whole Humboldt Forum, consisting of 6 levels on 96,356 m<sup>2</sup>
- ~20,000 visitors during a whole peak day (including ingress time)
- Three scenarios: different peak days

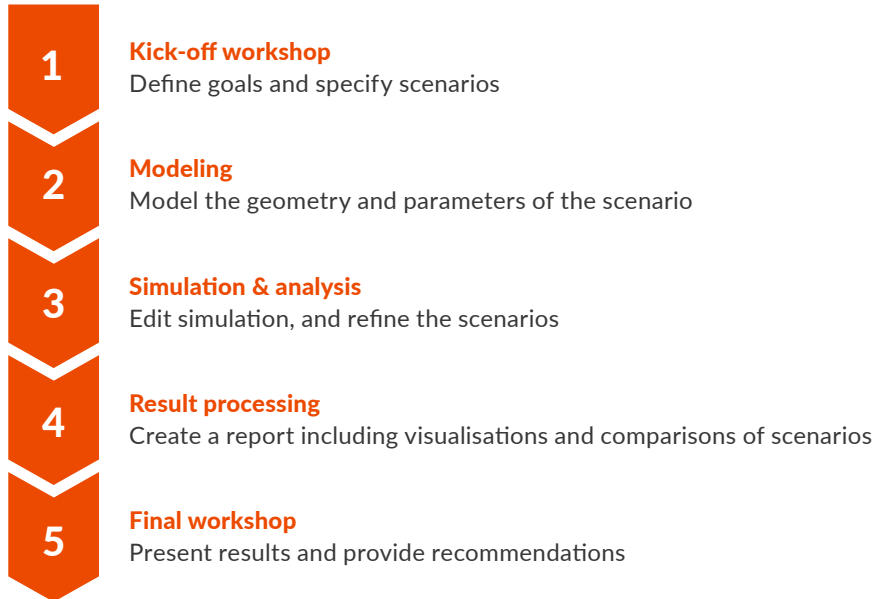
#### Results:

- Visitor flows visualisations for several scenarios.
- Insights into the capacity limits and bottlenecks on each floor.
- Recommendations to optimise the building for various visitor groups.



## From your initial question to profound results in 5 steps.

We adapt flexibly to individual requirements and guarantee timely delivery of high-quality results.



Throughout a project, we remain transparent and pride ourselves on close cooperation with our clients. Our iterative approach means we are flexible and adaptive to your needs.

### What do we need in order to simulate? Three basic ingredients suffice:

1. The initial question(s): what occasion should be analysed and under which boundary conditions?
2. Geometric plans: 2D CAD plans or BIM models.
3. Population data: e.g. population size, entry points and demographics, and scenario-specific information.

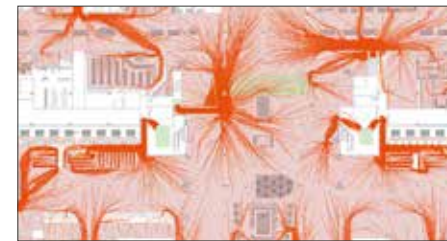
## It's all about communication – What you get.

### Meaningful results support analysis and communication:



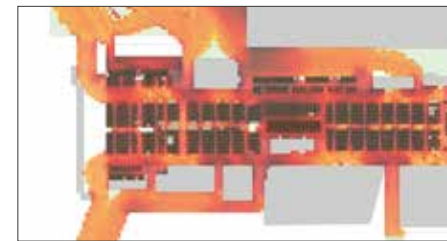
#### 2D videos

- ✓ Birds-eye view of the entire scenario
- ✓ Communication that everyone understands



#### Traces

- ✓ See efficient areas at a glance
- ✓ Identify main routes and paths



#### Heatmaps

- ✓ Detect bottlenecks and critical areas
- ✓ Identify passive areas



#### 3D videos

- ✓ Market your project
- ✓ Reduce cognitive overhead

**Would you like to know more about our solutions?  
Get in touch with us.**

E-Mail            [projects@accu-rate.de](mailto:projects@accu-rate.de)  
Phone            +49 89 21 55 38 69

**accu:rate GmbH**  
Institute for crowd simulation  
Rosental 5, D-80331 München