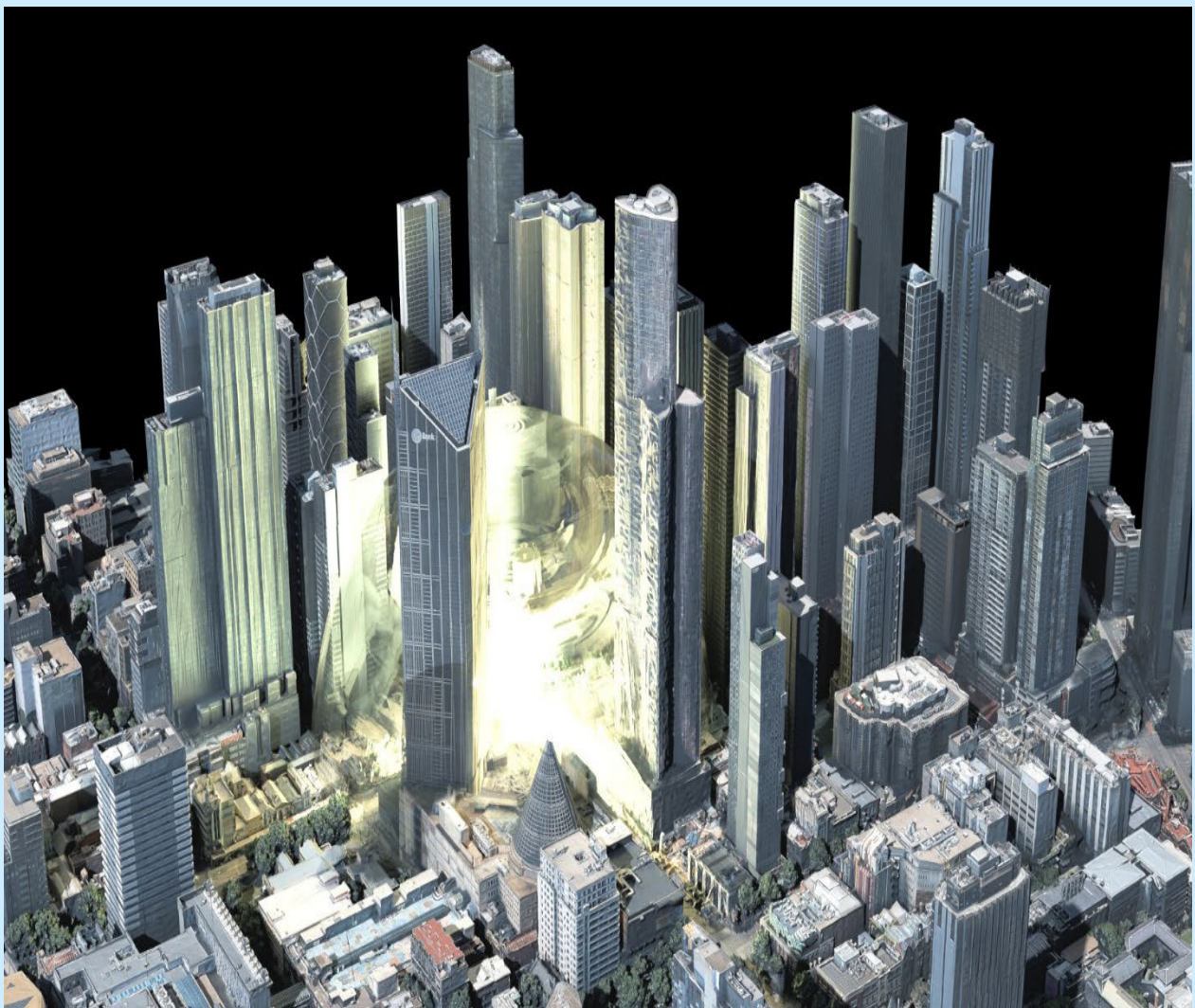


Cityscape Terrorism Explosive Blast Modeling



Cityscape Explosive Blast Modeling

Sunstone® is Guy Carpenter's market-leading approach to terrorism modelling. The core model offers an unparalleled approach to managing portfolio risk. With 1.5 million targets, it is a truly global model. With more than 40 attack types, it considers the full spectrum of events. This includes extreme-impact-but-rare events, but also the more simplistic, often opportunistic events that happen most frequently.

Guy Carpenter, a Marsh business, has an exclusive relationship with Synthetik Insurance Technologies for modeling explosive blast for reinsurance broking. Alongside Sunstone's core model, the firm has worked with Synthetik for 10 years to guide the development of Cityscape, utilizing a validated 3-D computational fluid dynamic (CFD) blast insurance model. Guy Carpenter has applied its understanding of market requirements and Synthetik has met these requirements with their advanced physics-based applied technologies.

The Market Requirement

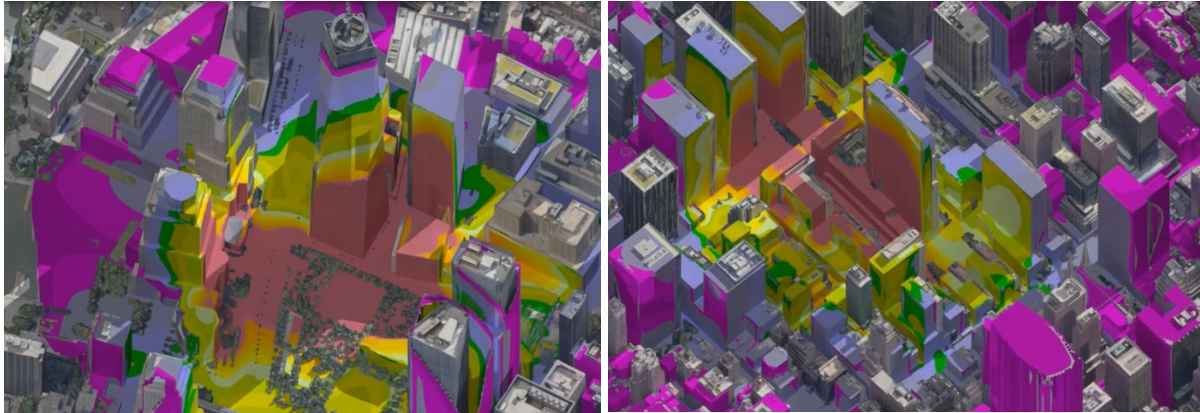
Cityscape addresses the (re)insurance industry's need to achieve both precision and efficiency when modeling explosive blasts, including terrorism.

There is a need to accurately estimate the effects of an explosion and subsequent loss so that the risk can be managed responsibly. However, the traditional industry use of concentric ring models is very simplistic and consequently conservative, meaning losses are often drastically overestimated. Cityscape's loss estimates are frequently 30-40% lower.

When relying only on radial assumptions, there is a risk that they smooth away the very concentrations of loss that drive clash losses and capital stress. With more precision, there is an opportunity to inform limits, inform insurance and reinsurance placements, and advise on sufficiency of capacity and underwriting decisions.

However, insurance processes must also be efficient to support timely decision-making. Radial models still have a role to play. Their speed, consistency and regulatory familiarity still make them useful for portfolio screening and year-on-year benchmarking. Functionality, accessibility and ease of integration with wider analytics and decision-making processes are also important.

Currently, the better answer is a dual-modeling strategy. Radial methods provide the market baseline and geometry-aware methods provide the realism needed to interrogate critical accumulations, validate reinsurance assumptions and explain why nominally similar locations can produce very different loss outcomes.

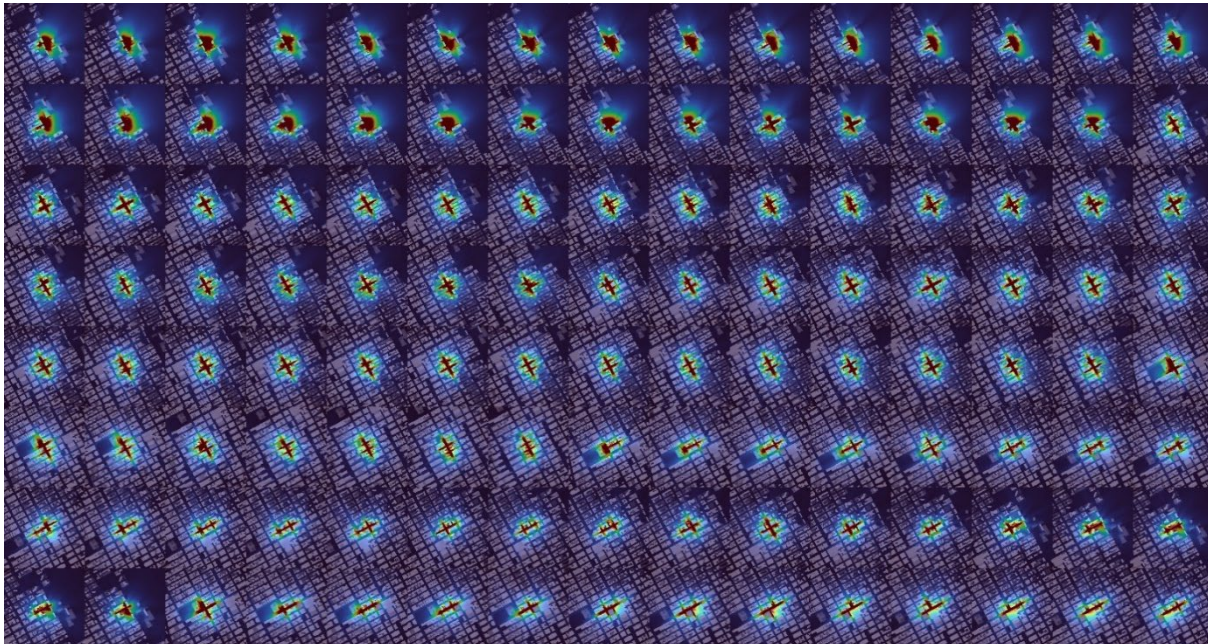


Cityscape blast model

A Physics-Based Approach

Rather than applying simplistic concentric rings of equal damage at distance, Cityscape considers the complex interaction of the blast shockwave with the built environment. Cities are not open terrain. In dense urban cores, towers shield one another, street canyons channel pressure and reflected waves can amplify damage in highly localized pockets.

In a traditional model, the people and property insured are simplified to a single point per building. In Cityscape, we often take thousands of points of measurement per building, allowing distribution of damage and injury across the building to be better understood (e.g., floor-by-floor). By recording multiple metrics for blast impact, property damage can be assessed with more precision and multiple mechanisms of injury considered.



Pre-run grid of scenarios and training material for machine learning

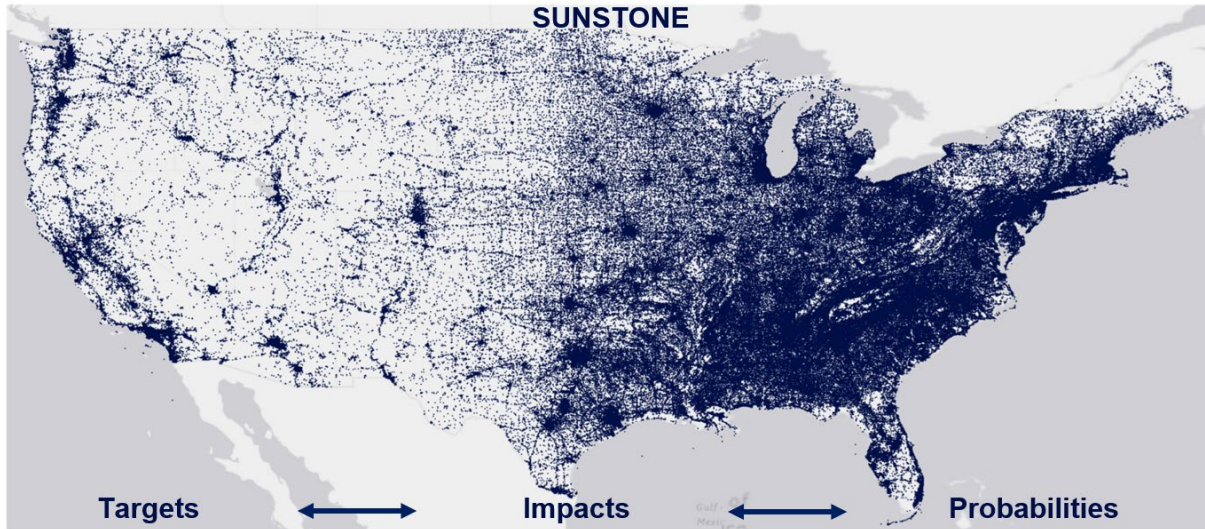
Continuous Improvement

Over 10 years, we have seen continual development of modeling capability as the technology has advanced. What was once possible for a single building is now possible and practical for many buildings within a city block affected by large explosions. This meant insurers' portfolios in peak aggregations could be modeled. The speed of analysis in hours was a significant improvement over other models, although this still limited its practical application. Other improvements include the following:

- The Cityscape web app has facilitated ease of use in-house at Guy Carpenter. The geometry in the app is now available globally.
- Parallel processing allows hundreds of scenarios to be run in the time it would have taken previously for just one.
- This amplification means that peak areas can be pre-modelled, with the precision of CFD, in an instant. Pre-run grids offer real-time utility to wider insurance analytics and decision-making, such as underwriting.
- This step-change in the order of magnitude of analyses being modelled provides a wealth of training material making machine learning possible. A physics-informed neural network (PINN) emulation of CFD can provide the majority of the benefit in a fraction of a second and be applied to wider areas and geographies.
- This will potentially remove the need for concentric rings as a pragmatic alternative.

Cityscape also paves the way for 3-D emulation of explosive blast to be integrated into probabilistic insurance models in the future. The downside of deterministic scenario modeling is that it does not encompass the full portfolio of insured assets and does not account for the real-world uncertainty of where events may occur, what events may occur and how likely they are. The threat of political violence, including terrorism, is increasingly broad, diverse and uncertain, and probabilistic modeling is the best way to capture this. Integration of Cityscape into a probabilistic model will marry precision, efficiency and future uncertainty.

As threat profiles evolve and insured values continue to cluster in global city centers, the market will need tools that are not merely computationally convenient, but physically credible. High-fidelity urban blast modeling answers that need by showing not only how far damage travels, but how it is reshaped by the city itself.



Sunstone probabilistic modeling methodology

How Guy Carpenter Can Help

Guy Carpenter, a Marsh business, brings together the power of analytics and advisory via a multi-model approach to address ever-changing, complex terrorism risks. Our Terrorism practice draws on the expertise of Guy Carpenter specialists in property, workers compensation, accident and health, cyber and other risk areas to tailor comprehensive terror and political violence solutions for our global clients.

Sunstone Cityscape, powered by our exclusive partnership with Synthetik Insurance Technologies, provides access to a validated, physics-based model, delivering advanced 3-D CFD blast risk insights tailored for reinsurance broking. Cityscape integrates outputs into broader insurance analytics and future probabilistic models, empowering clients to inform limits, optimize insurance and reinsurance placements, assess capacity sufficiency and validate underwriting and reinsurance assumptions with greater confidence.

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