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Terror and Pandemic Modelling for Life Insurance

04 May 2017

Key Messages

- The world is changing dramatically in terms of life extreme event risk – terror and pandemic
- Winners will have the right data, models and communication
- Risk can be managed by keeping the portion you are happy to report losses on

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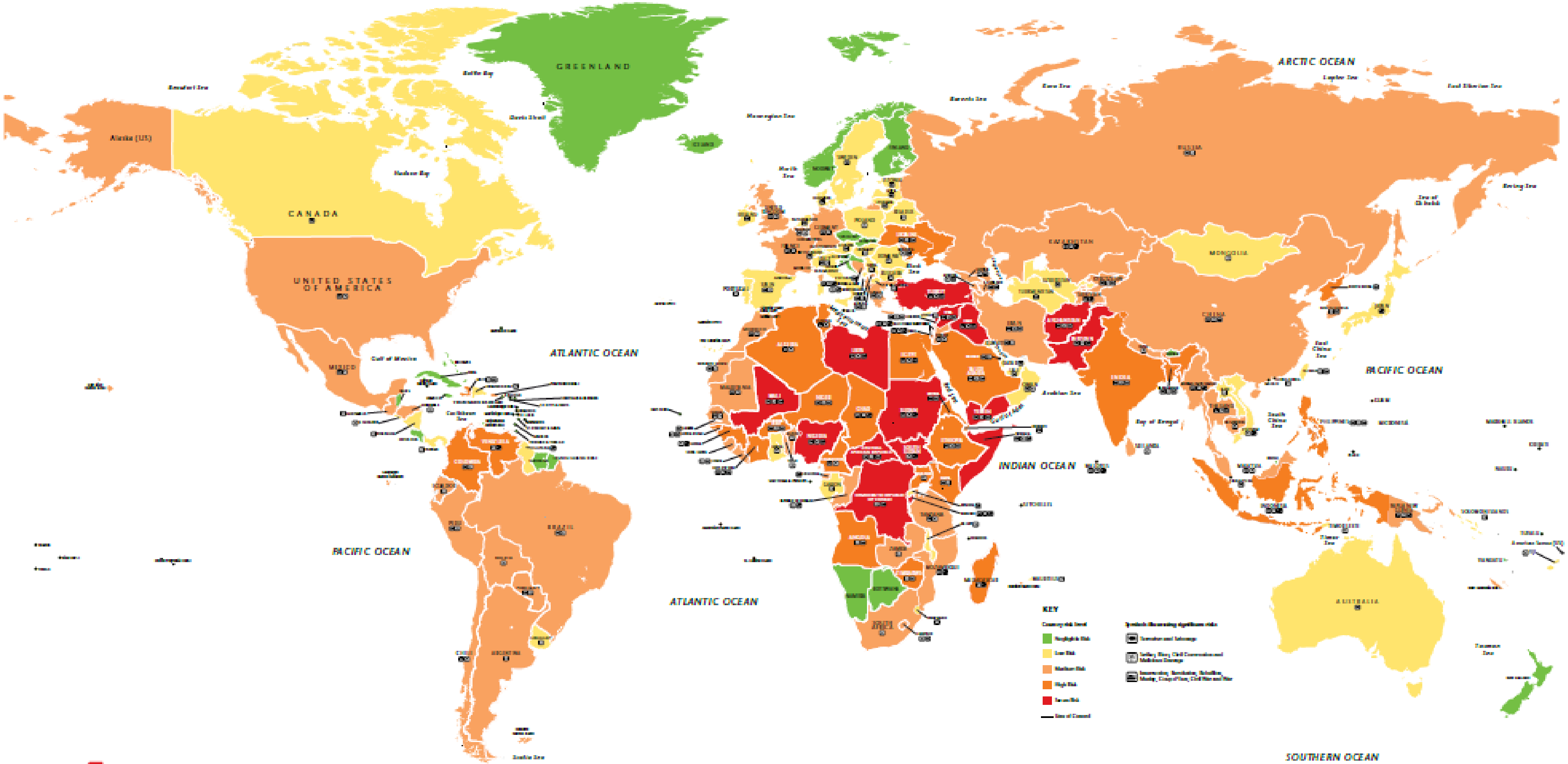
There are big changes happening in the world

2017 Terrorism & Political Violence Risk Map



Empower Results®

Aon's approach to terrorism and political violence risk management combines threat assessment, impact analysis and crisis management consulting, with individually structured insurance programmes. For further information, visit: aon.com/terrorismmap

This map is intended for general use only and should not be used for legal or navigational purposes. The boundaries and names shown do not assert any legal status of any area or the

RISKADVISORY

About The Risk Advisory Group plc
The Risk Advisory Group is a leading independent global risk consultancy that helps businesses grow whilst protecting their people, their assets and their brands. By providing facts, intelligence and analysis, The Risk Advisory Group helps its clients negotiate complex and uncertain environments to choose the right opportunities, in the right markets, with the right partners.

Total Terrorist Attacks by Region in 2016

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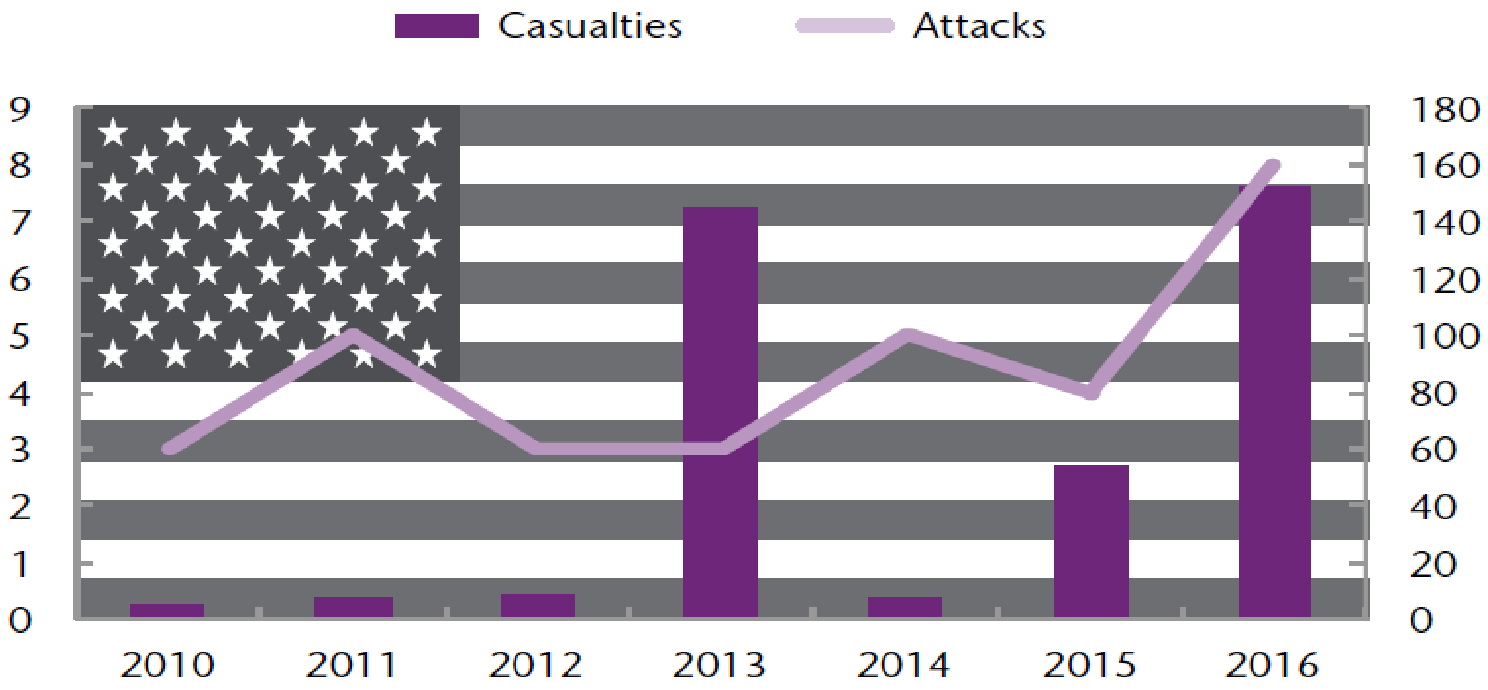
Source: Aon’s 2017 Risk Maps for Political Risk, Terrorism and Political Violence

Terrorist Attacks in the US by Year



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Source: Aon’s 2017 Risk Maps for Political Risk, Terrorism and Political Violence

Historical Pandemic Events

01

Event	Spanish flu
Year	1918
Attack rate	35%

02

Event	Asian Flu
Year	1957
Attack rate	25%-30%

03

Event	Hong Kong Flu
Year	1968
Attack rate	25%-30%

"Over the past 300 years, at least six pandemics of influenza have probably occurred, including three well-characterized ones in the 20th century."
American Society of Microbiology

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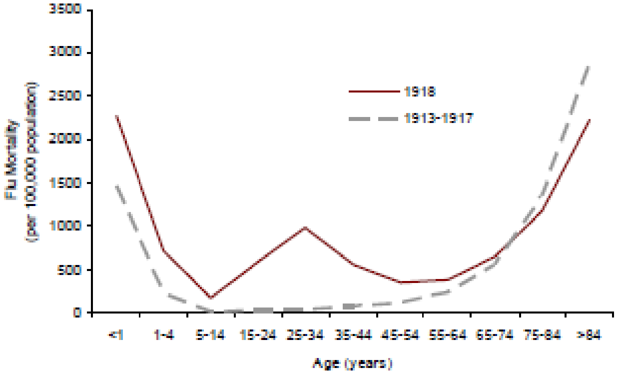
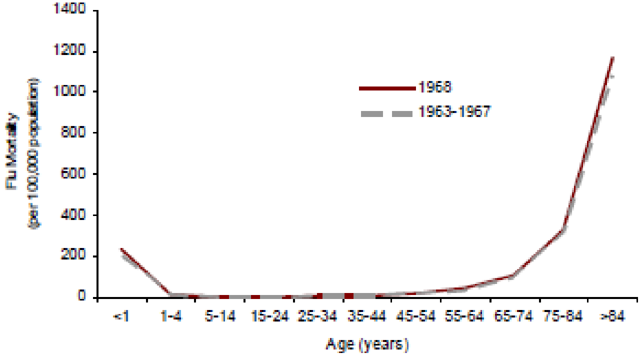
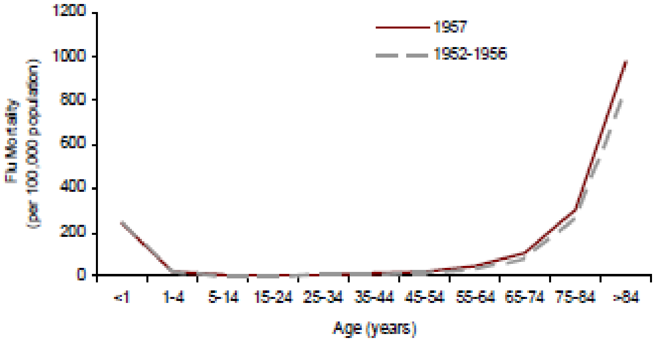
Different Pandemics Impact Different Age Groups







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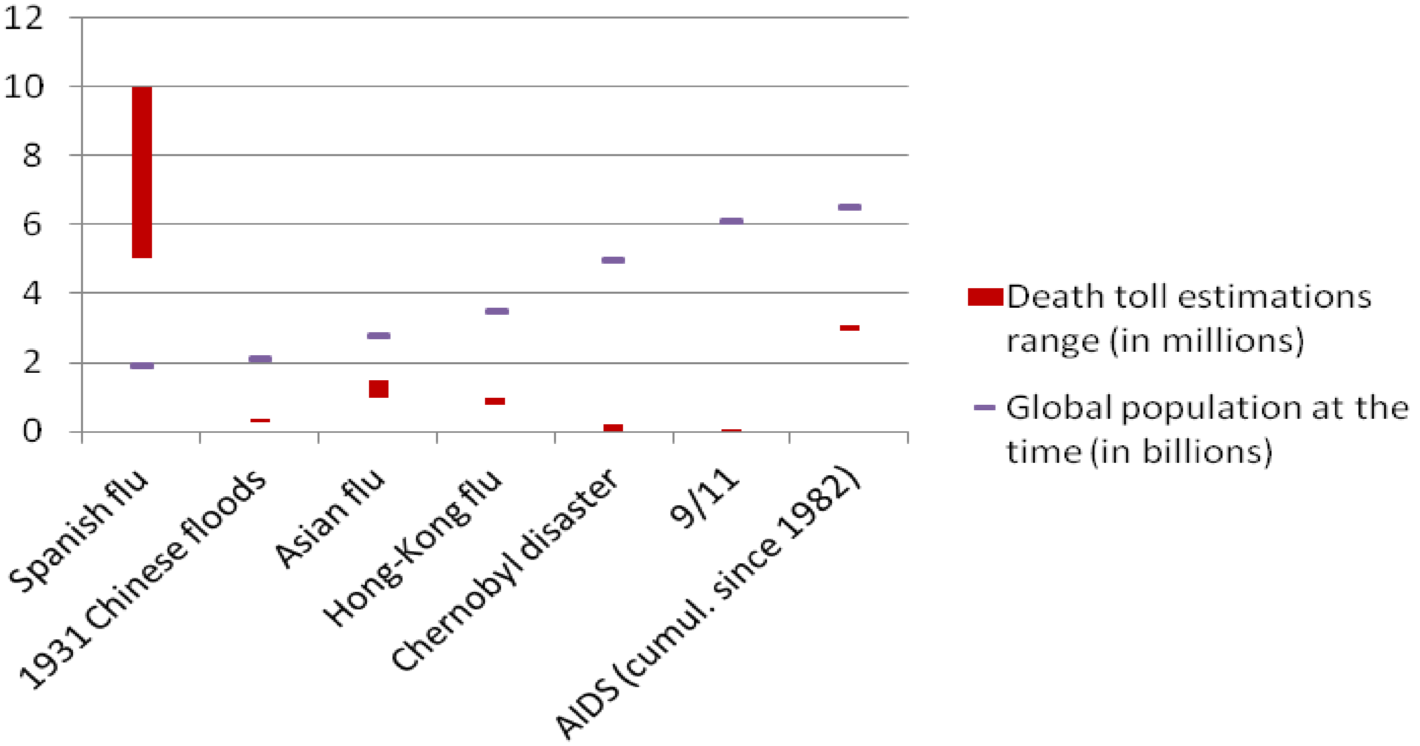
Pandemic Death Risk



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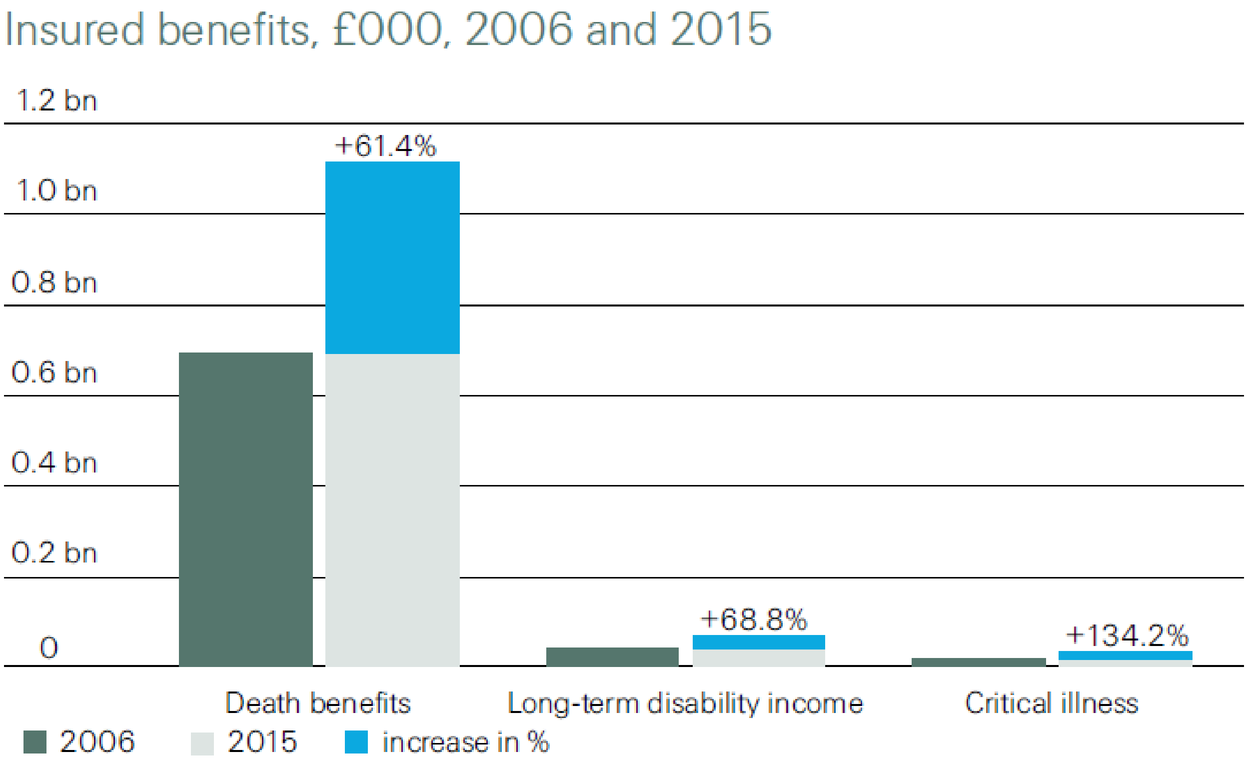
UK Group Life Insurance Exposure

Figure 2

Death benefits
2006: 688,568,346
2015: 1,111,518,985 +61.4%

Long-term disability income
2006: 38,543,558 p.a.
2015: 65,080,712 p.a. +68.8%

Critical illness
2006: 13,524, 285
2015: 31,677,208 +134.2%



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Winners and Losers

Winners do their Homework

Good Data
1

Good Models
2

Regular Review
3

Appropriate Metrics
4

Appropriate Reinsurance
5

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Best Estimate Losses are a Moving Target

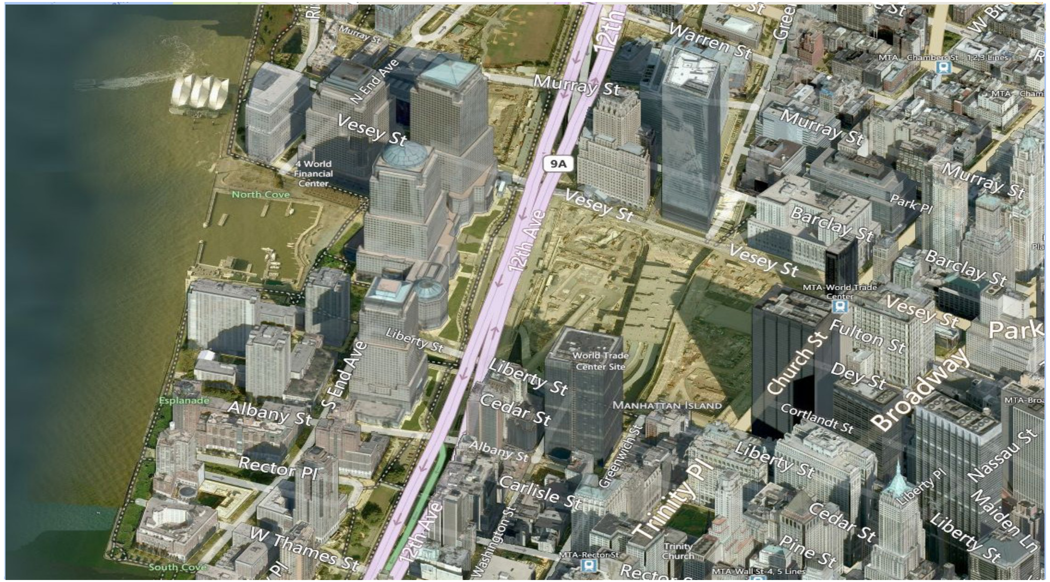
1. Underwriting
2. Ageing population
3. Premium Rates
4. Mortality Improvement Dislocation

Event Footprints

- Pandemic Footprint
  Earth is ~ 57 million sq. mi

- Earthquake
  10k sq. mi

- Terrorism
  A couple of city blocks



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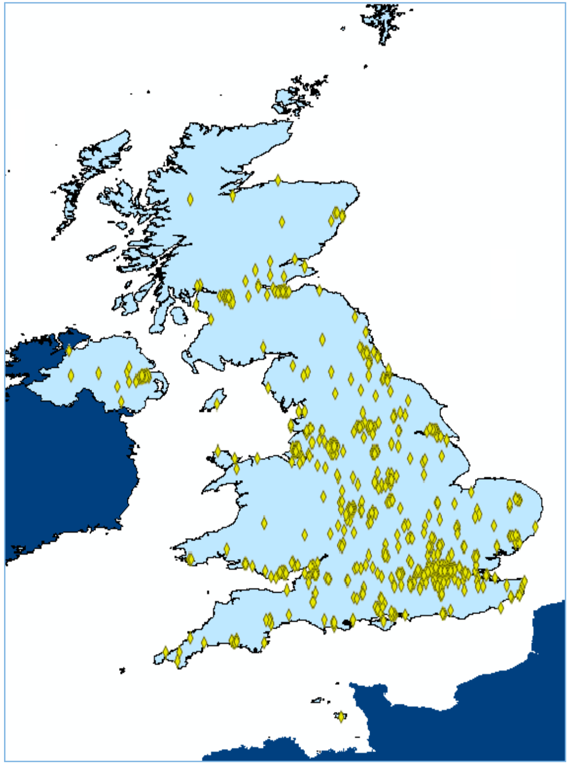
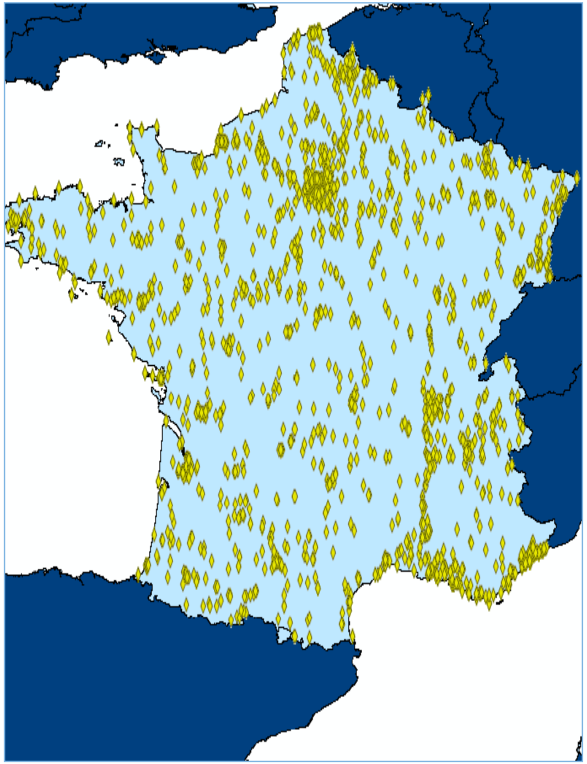
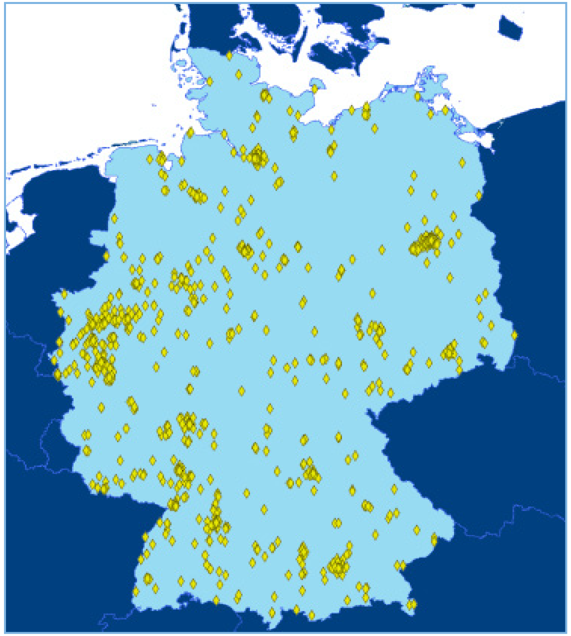
Source: Aon ImpactOnDemand

Terror Target Database







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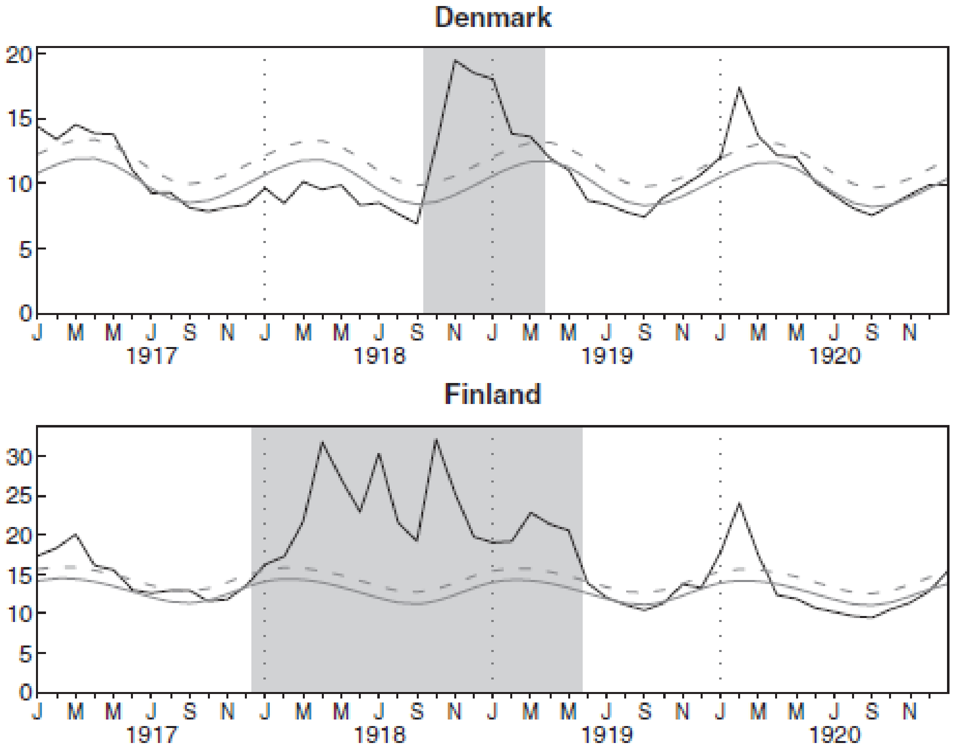
Source: Aon's Impact Forecasting Terror Database

Pandemic Modelling – Spanish Flu



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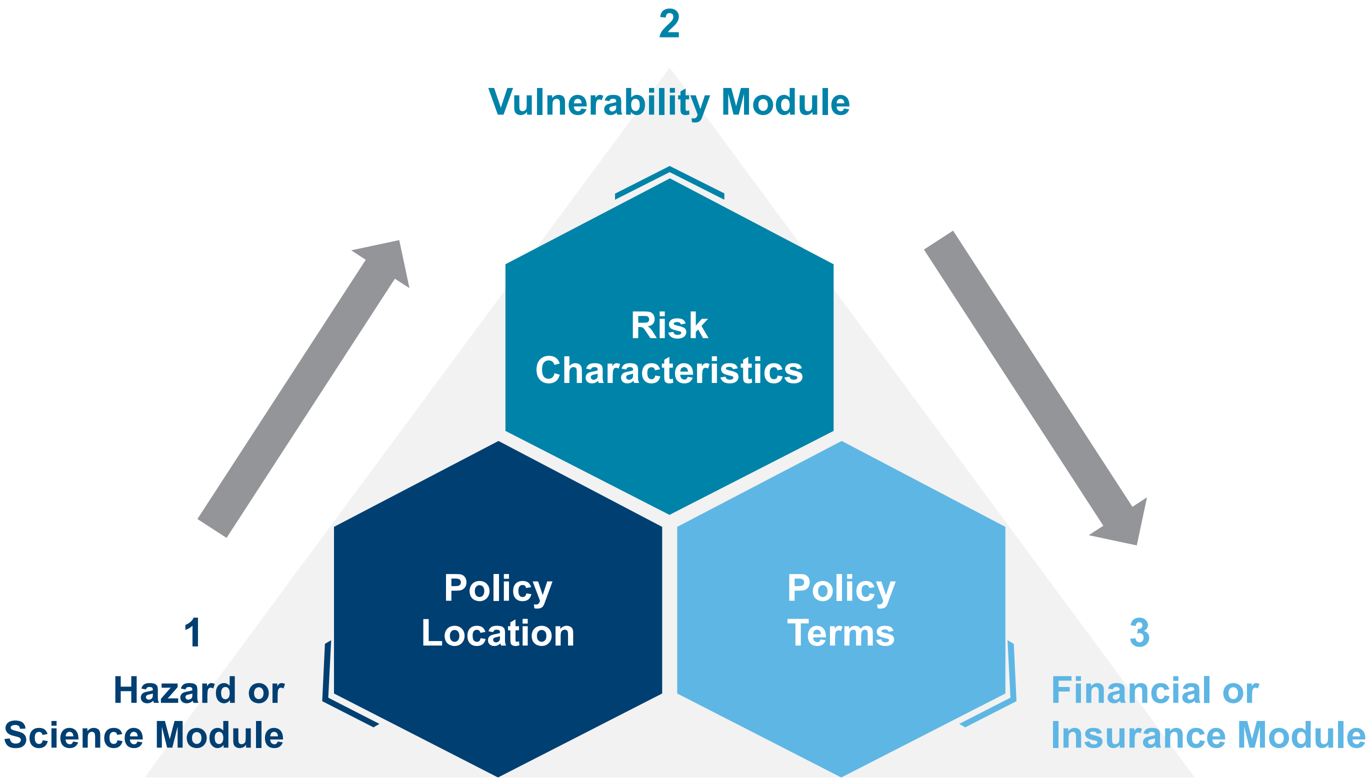
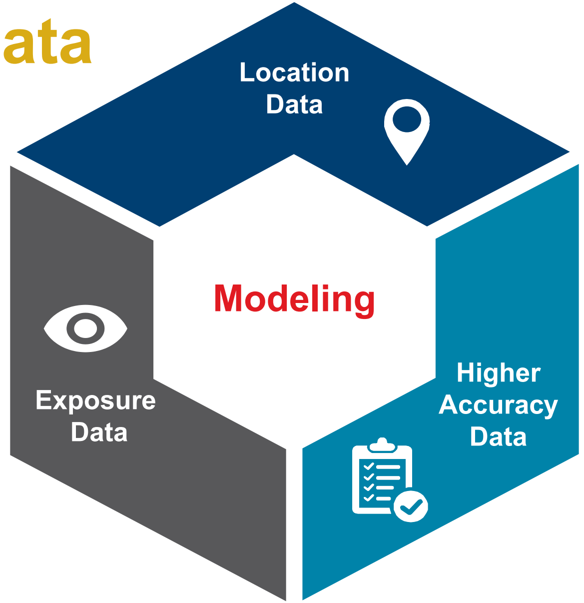
How to adapt to the new world

Catastrophe Model Framework



Collecting Good Data



Location Data

- Street Address, City, Post/Zip Code, County/State, Country
- Latitude and Longitude
- Can supplement data from other sources
  - Avention (OneSource)
  - Dun & Bradstreet
  - Sanborn CitySets® database
  - Census and other government databases

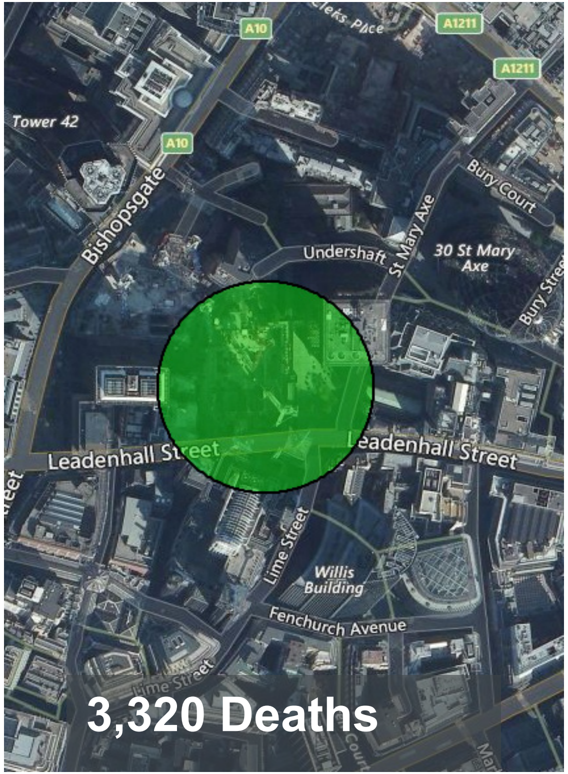
Exposure Data

- Line of Business, Net Retained Sums Insured, Aggregate Limits, Payouts
- At Work vs. At Home
- Age Bands

Higher Accuracy Data

- Construction Type (e.g. year built, number of stories)
- Occupancy Code (e.g. type of industry and occupations in building)

Need to know where the staff are



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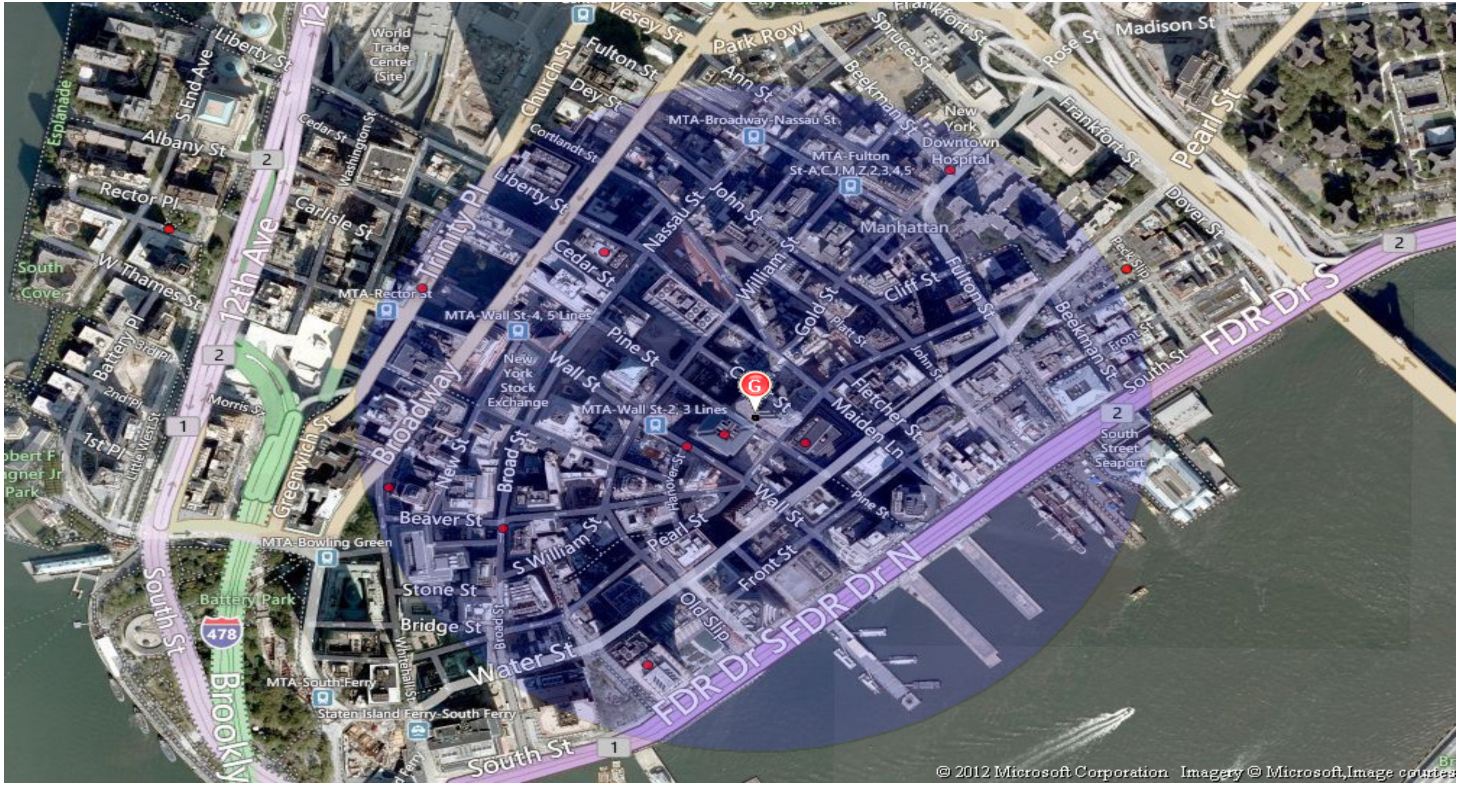
Source: Aon ImpactOnDemand software. Image Microsoft Imagery

Before Home to Work Distribution – Wall Street Client



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Source: Aon ImpactOnDemand software. Image Microsoft Imagery

After Home to Work Distribution – Wall Street Client

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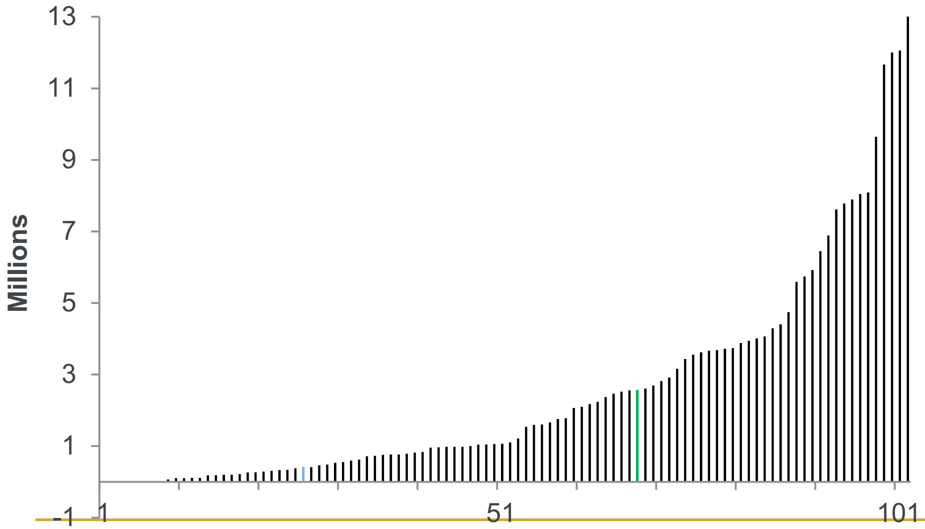
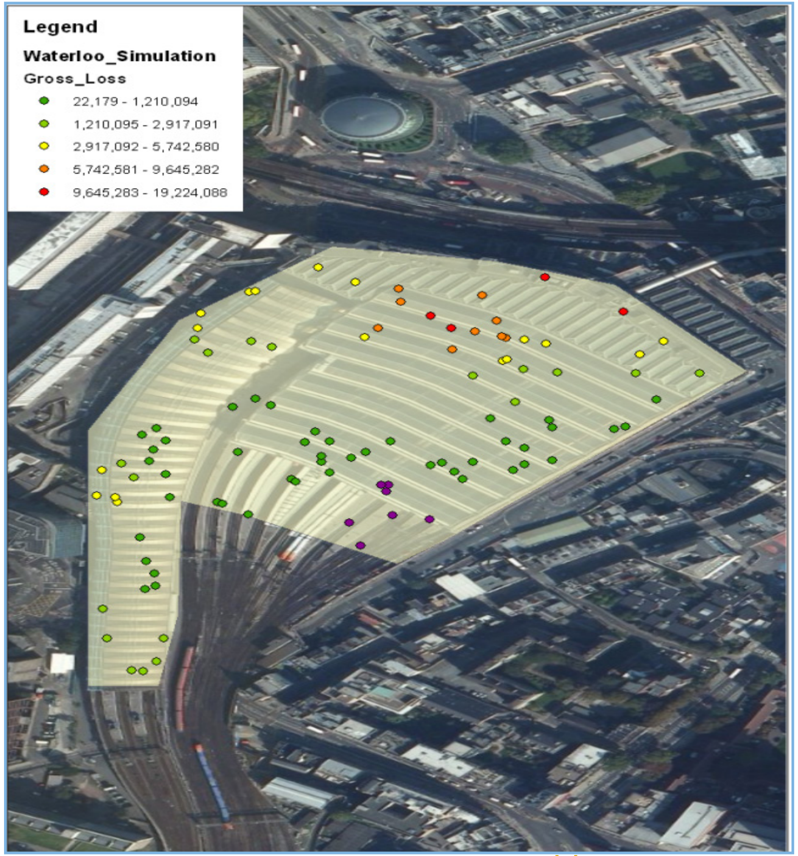
Source: Aon ImpactOnDemand software. Image Microsoft Imagery

Waterloo simulation

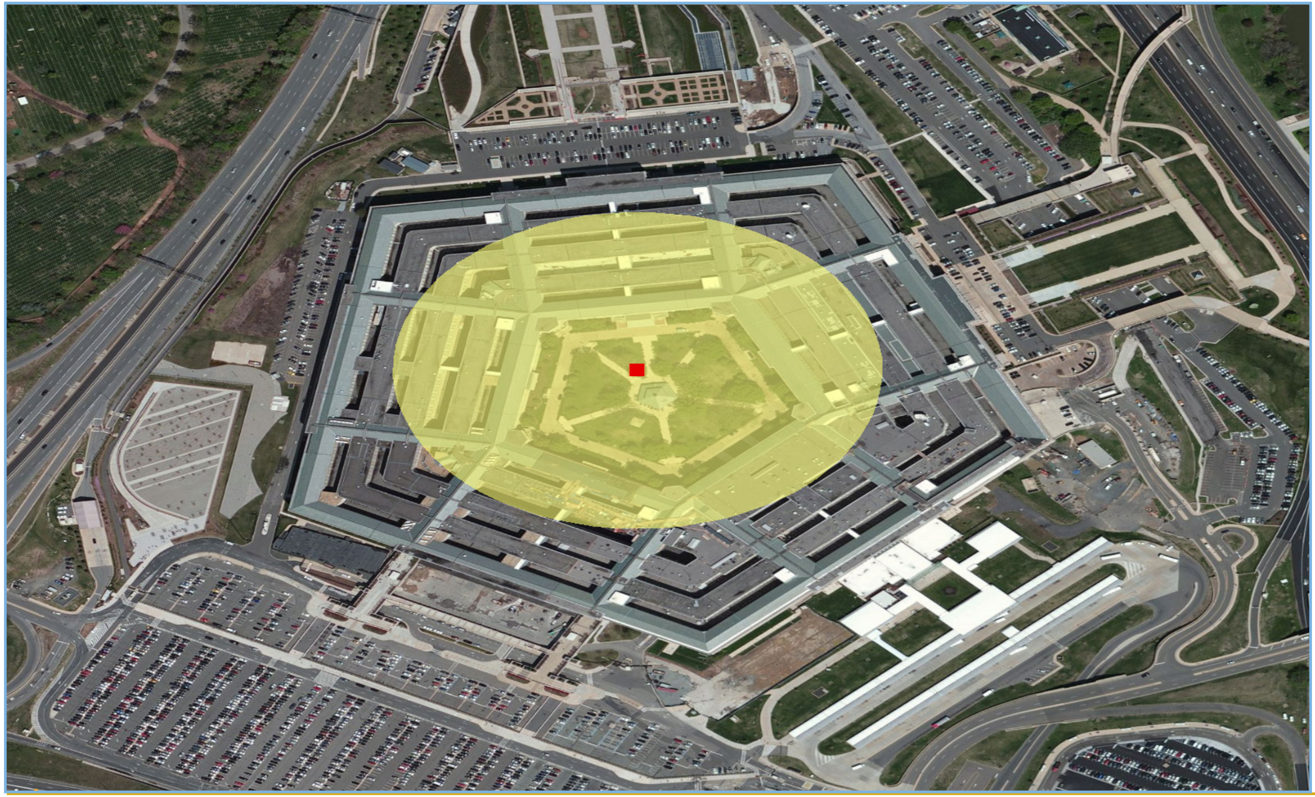
- VBIED (Car Bomb) against Waterloo train station on a synthesised client portfolio
- Using the centroid produces a loss of £**400k** which grossly underestimates the potential damage that could accrue. This example produced a mean loss of **£ 2.5m**



Source: Aon Modelling



Hazard component Example: The Pentagon



Source: Aon. Image Microsoft Imagery

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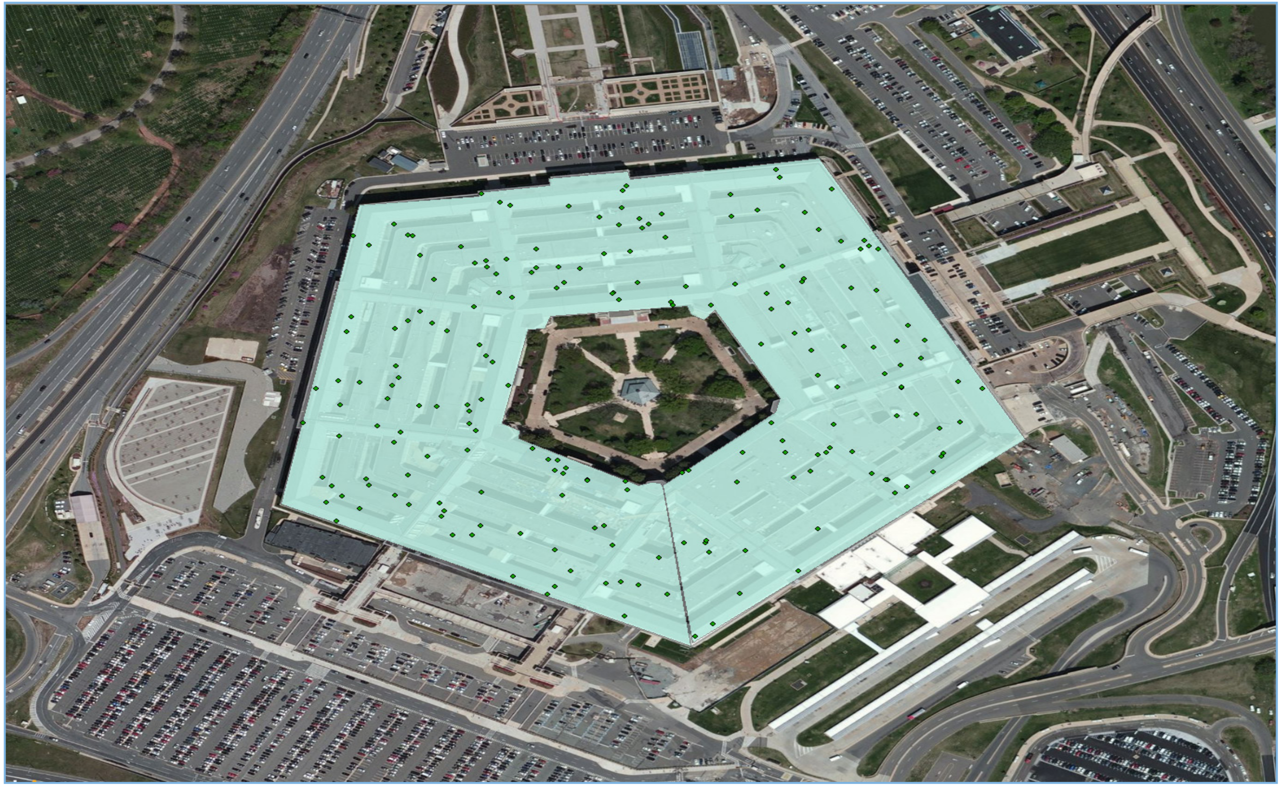
The solution is polygon with multiple attack points



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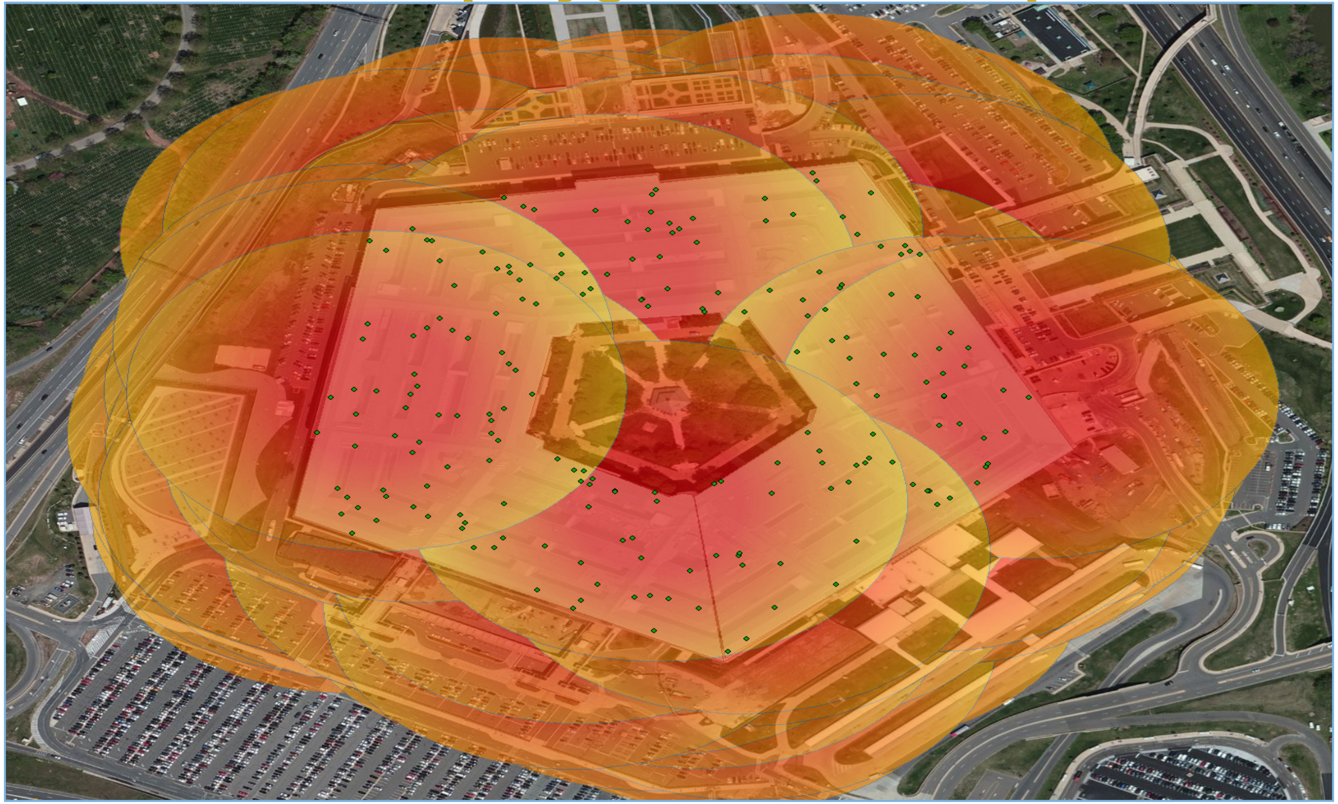

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In Comparison to Reality

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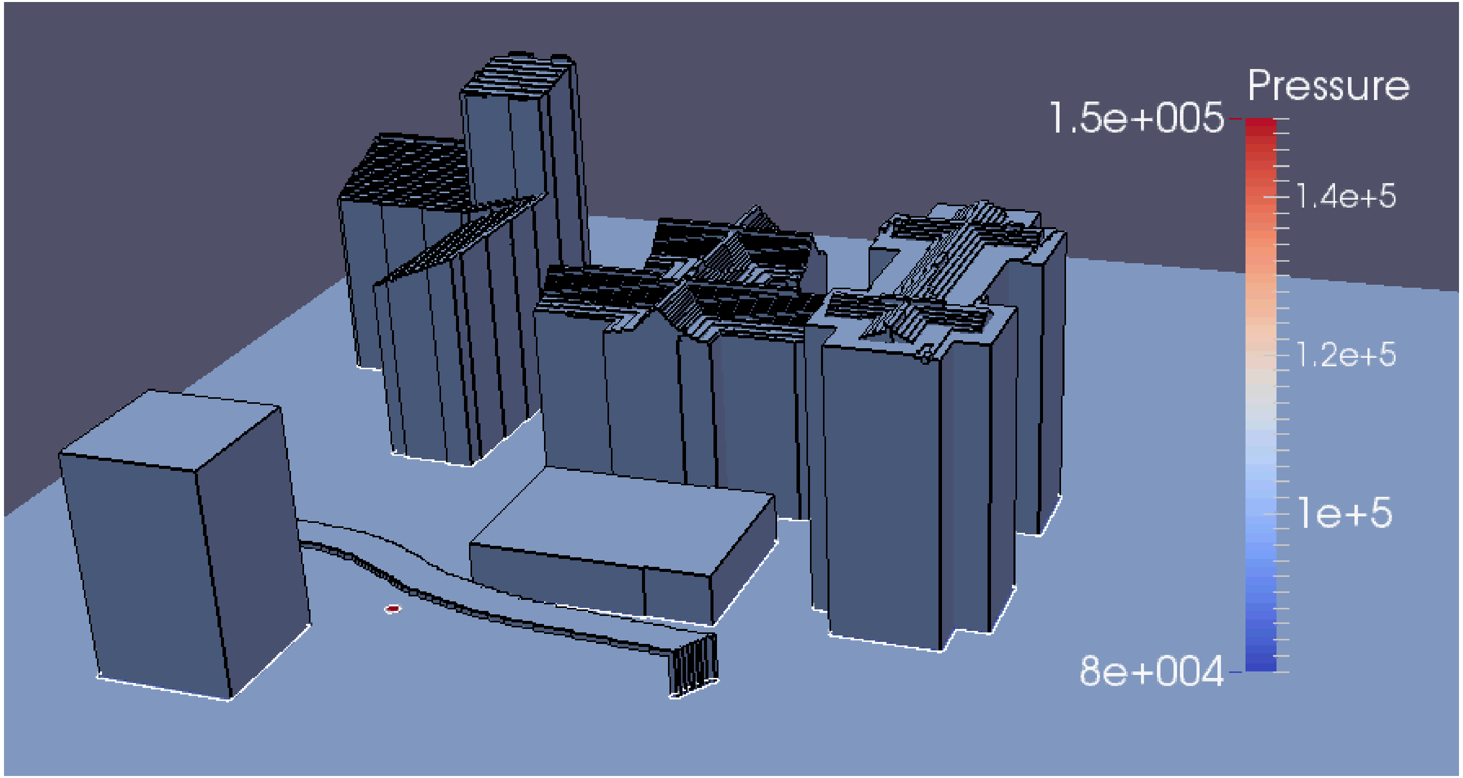
Blast Simulation – Docklands 1996



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Source: Aon Modelling

Blast Simulation – Docklands 1996

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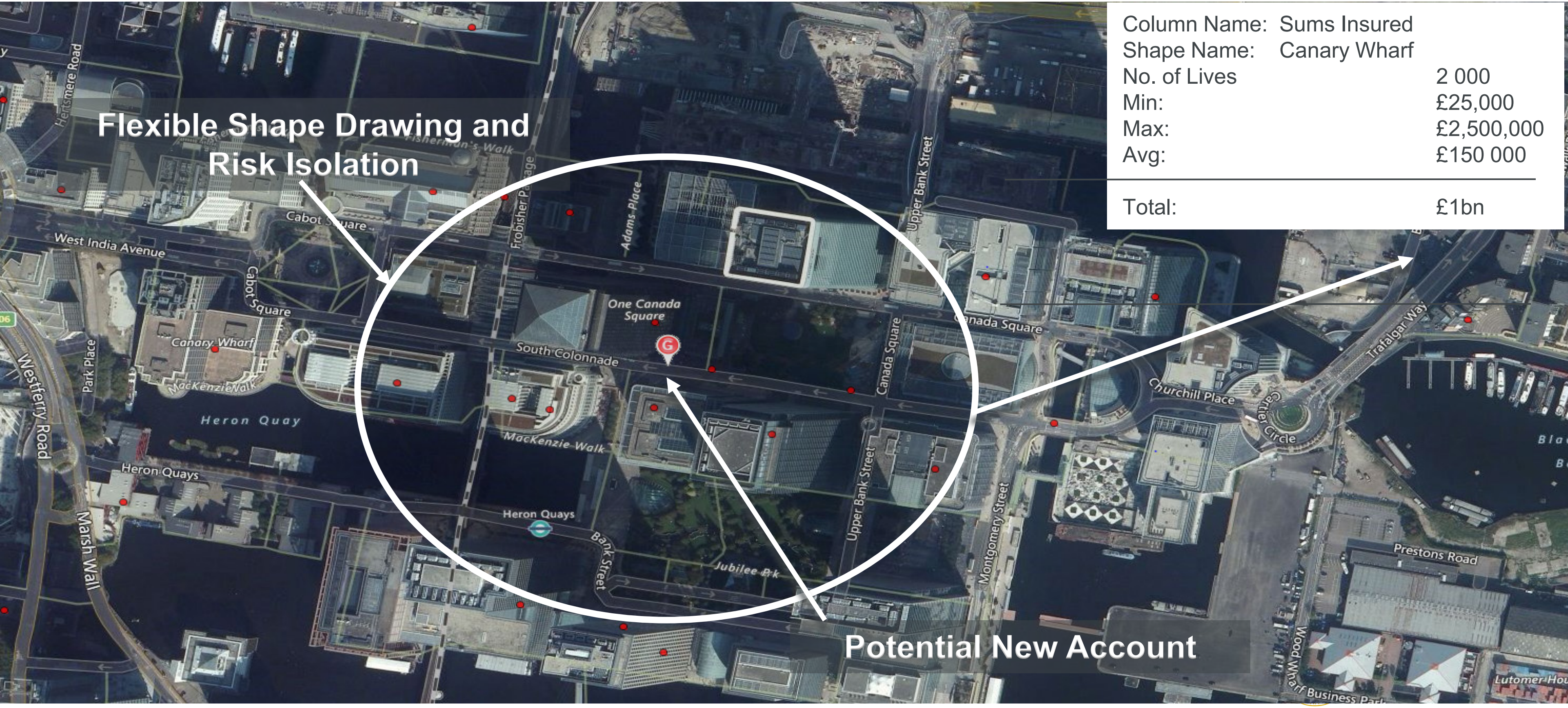
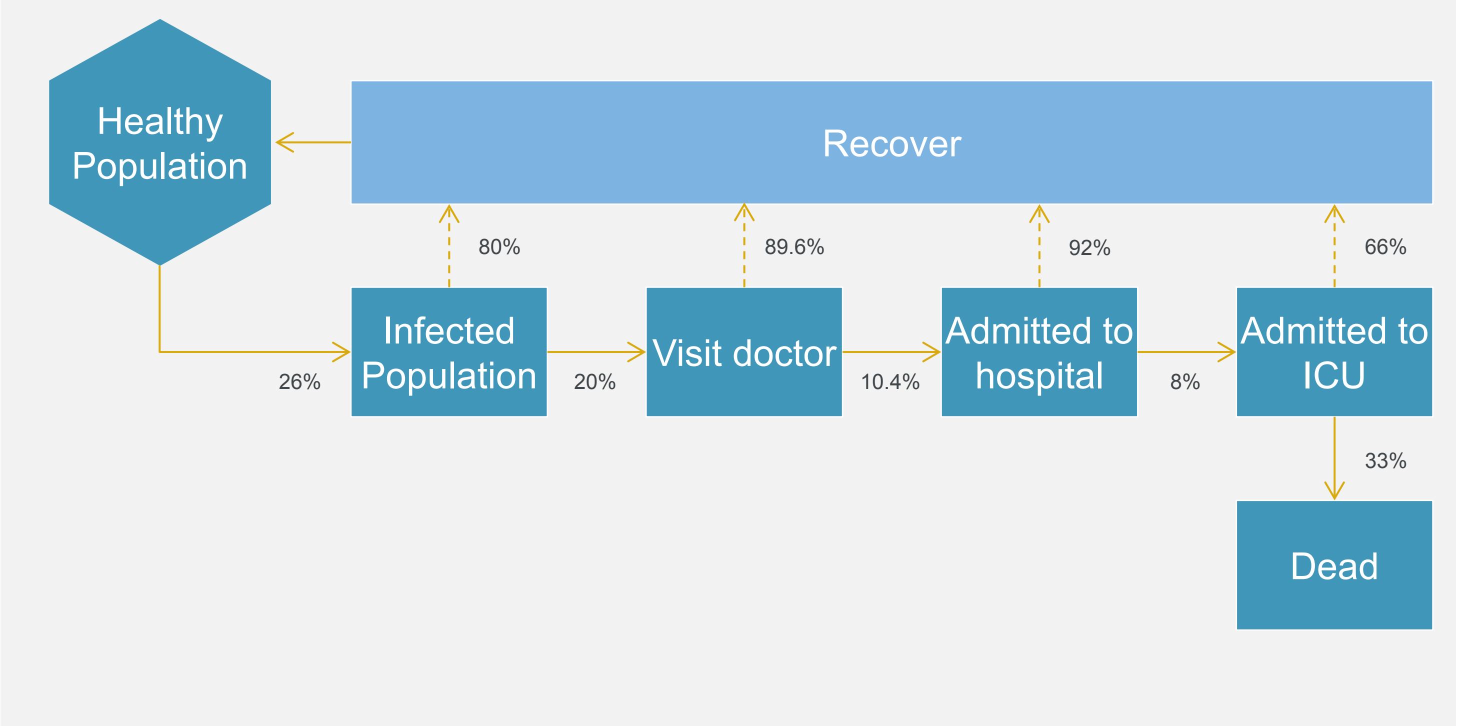
Pre-quote Monitoring on Underwriting Desktop



Source: Aon ImpactOnDemand software. Image Microsoft Imagery

Modelling Pandemic for Health Business



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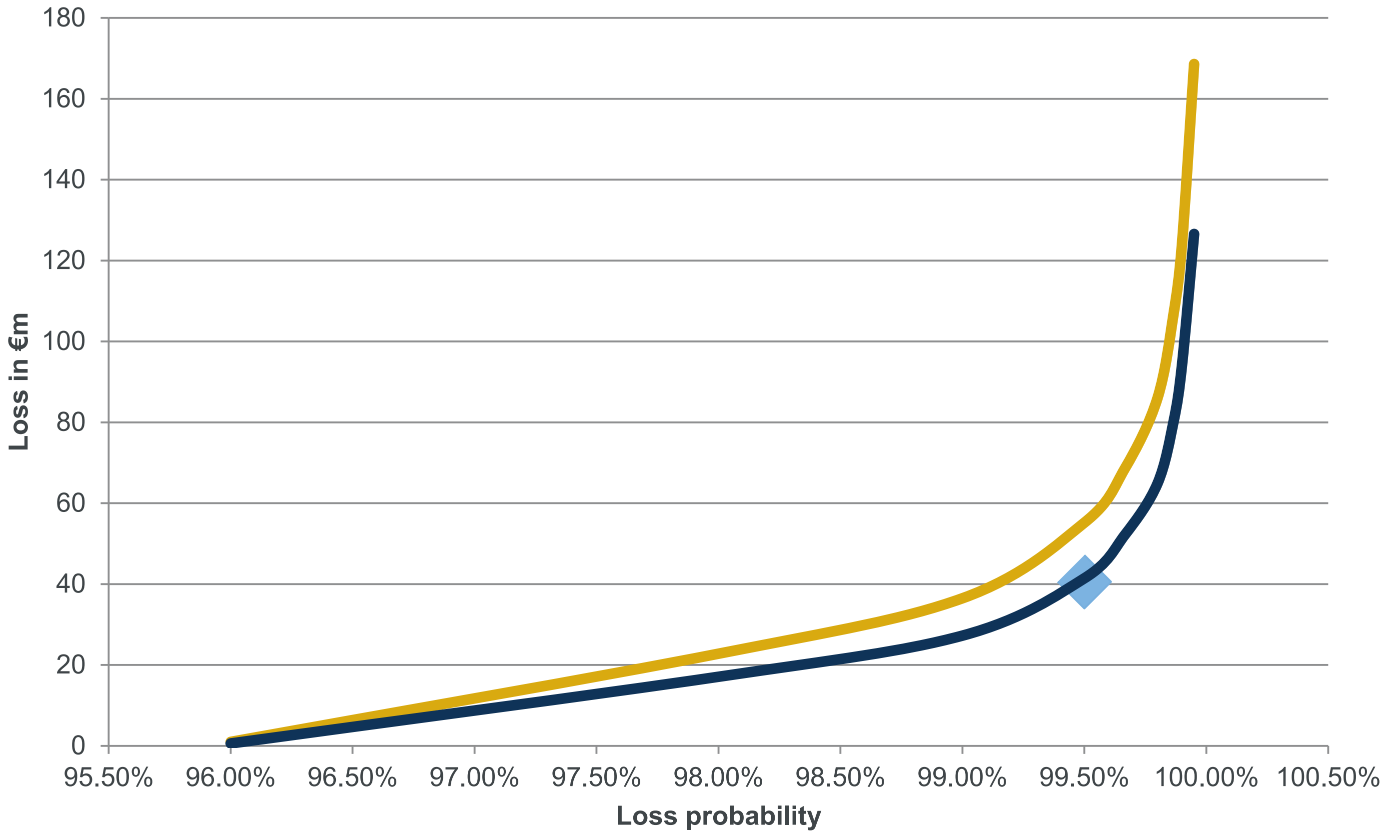
Source: Aon Modelling

Modelling Pandemic Loss



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Source: Aon Modelling

Risk Mitigation

Cat Cover

- £1bn capacity (possibly)
- Prices have hit a floor
- Specific pinch points in London
- Need follow the money: Employer – EBC – Insurer – Reinsurer – Capital Market

Pandemic Cover

- Considerable capacity
- Prices stabilized
- Pandemic trigger definition uncertainty
- Solvency II compliant structuring

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What I have just told you

Key Messages

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