Rain Check:
A Hard Look at Weather’s Impact on the Construction Process & the Granular Data Now Promising to Clarify the Risks
Agenda

1. Introductions
2. Natural disasters on the rise: Parallel impact on construction industry
3. Construction point of view: Managing weather risk in today’s world
4. Big data advantage: New models & analysis to change planning, scheduling, & risk management
5. Conclusion
Athenium Analytics background

- Web-based **decision-support** software for construction organizations, insurance, government & financial trading
- Industry-leading products for **risk management**, quality assurance, underwriting & claims
- **115 employees** across three offices in Washington D.C., Waltham, MA, and Dover, NH
- Mostly made up of **scientists & technologists**
  - Meteorologists, structural engineers, data scientists, product developers and software engineers
Natural disasters on the rise:
Parallel impact on construction industry
Weather risk in construction

“The construction industry loses billions of dollars on delays and failures caused by bad weather. Buildings are damaged during storms; sites turn into seas of mud; freezing temperatures make it impossible to pour concrete.”

“Every state in the country has been impacted by at least one billion-dollar disaster since 1980.”
More extreme weather disasters

14

Weather disasters with losses exceeding $1 billion in 2018
Annual disasters have doubled

6.2
Average annual $1B+ disasters:
1980 - 2018

12.6
Average annual $1B+ disasters:
2014 - 2018
Changing climate

- Heavy-precipitation events have increased by 30% in the last century
- Temperatures have risen more than 2 degrees since 1950
- Days above 90 degrees expected to increase on average 20-30 days by 2050
A costly risk

“UK weather extends project durations by an average of 21%. However, using climatological data derived from weather observations when planning could lead to average reductions in project durations of 16%, with proportional reductions in indirect and overhead costs.”

- Ballesteros-Pérez et al (2018) Incorporating the effect of weather in construction scheduling and management with sine wave curves
Construction point of view:
Managing weather risk in today’s world
Corpus Christi LNG project

CAT MODELLING REPORT

Corpus Christi LNG Project

Report – DRAFT Issue 03
August 2014
Weather impacts are not uniform
How will your supply chain be affected by weather?
Winter impacts on craft workers
Can you contract away weather risk?

How does the contract deal with weather?
• Force Majeure
• Normal vs “Unusual Weather”
• Change Relief
Publicly available data
Weather risk considerations in estimating

- Project location
- Underground vs above ground work
- Forecast of non-working days
- Worker Productivity impact
- Consideration of “normal” weather impact
- Consideration of abnormal weather impacts through duration of work
Big data advantage:
New models & analysis to change planning, scheduling, & risk management
Computing power & weather forecasting

• More and more data each day!
  o 500 million tweets
  o 300 billion emails
  o 28 petabytes of data from wearables each day
  o Entire digital universe is expected to reach 44 Zettabytes by 2020!!!

• Weather forecasting
  o Better computing power
  o Improved understanding of the atmosphere
  o Developments in numerical modeling & data assimilation
  o Modern 5 day forecast is better than a 1-day forecast from 1980
Gridded weather data – a better solution

Intersecting project with gridded data provides opportunities for local weather risk analyses

• Not dependent on observation facilities
• Not dependent on weather station hardware on-site
• Real-time analysis for forecast & post-event
Why is blending better?

Weather models can have biases
- Specific times of day, geographic locations, types of events, etc.
- E.g. GFS (American model) does poorly in cold-air damming situations
- E.g. ECMWF (European model) tends to move storms too slowly from west to east coast

Why not use a free weather app?
Algorithmic blending – a way to improve forecasts

Increase in temperature accuracy

<table>
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<th>Day-5</th>
<th>Day-6</th>
<th>Day-7</th>
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Increase in wind speed accuracy

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<tr>
<td>vs. ECMWF</td>
<td>5%</td>
<td>8%</td>
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Post-event analysis – a “virtual” weather station

Blended radar, satellite & modeled post-event data allows for high-resolution, 0.3 to 1.5-square-mile verification of project-specific weather events

- Straight-line wind (surface & elevation)
- Hail
- Rainfall
- Snowfall
- Freezing rain
- Temperature

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Hyper-local analysis better than station data

Max Dist. 34 miles

Avg. Dist. 12 miles
Verifying project wind gust speeds – station data

Why the flat peaks?
Verifying project wind gust speeds – hyper-local data

Modeled maximum wind gusts offers greater resolution & site-relevance
Verifying project wind gust speeds – hyper-local data

Difference in wind gusts between hyper-local data & nearest station data was upwards of 20-30 mph in some areas
Verifying project rainfall – NOAA data
Verifying project rainfall – NOAA data
Verifying project snowfall – NOAA data
Verifying project snowfall – NOAA data
Minimizing weather delays

Weather delays can be expensive for a construction project

- Labor costs
- Equipment costs
- Material costs
- Subcontractor costs
- Storm damage costs
- Contractual costs

Accounting for weather delays while bidding, scheduling, & planning your project can help reduce costs & mitigate delays
Lost weather days

Predicting non-working weather days can be tricky

- Weather stations may be miles away
- Data may be limited and inconsistent
- Analysis may be complicated and time consuming
Using historical weather data to plan ahead

Weekly Weather Risks for Framing | January - December
Weather risk variation

Right: Maximum weekly risk scores for a combination of weather perils & thresholds relevant to **foundation** work, over 1 year

Below: Weekly **foundation** risk for points A and B

A:

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B:

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<tr>
<td>05/10</td>
<td>AVERAGE RISK</td>
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</table>
Weather risk variation

Right: Maximum weekly risk scores for a combination of weather perils & thresholds relevant to excavation work, over 1 year

Below: Weekly excavation risk for points A and B

A:

B:
Conclusion

- With a changing climate, there is an even greater need for granular, project-specific weather information
- While forecasts & computing power have improved, station data & free weather app data have their limitations
- Installing high-quality weather stations in linear projects (or others) can be cost-prohibitive
- How are you currently trying to de-risk the weather?
  - Contractually
  - Risk management
  - Project management