Modeling Secondary Catastrophe Perils

CAS Spring Meeting
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Agenda

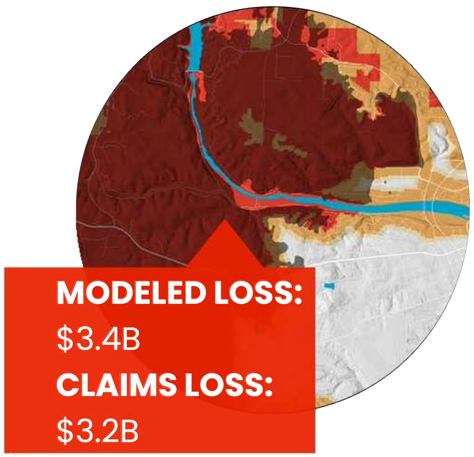
- Different types of Natural catastrophe models and their uses
- Why some perils are modeled differently than others
  - Locational accuracy
- Modeling Severe Convective Storm

CoreLogic

Types of Natural Catastrophe Models

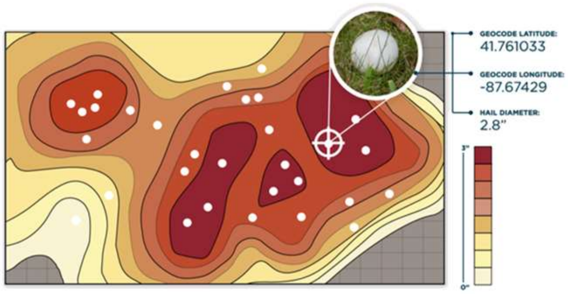
DETERMINISTIC

What could happen?



PROBABILISTIC

What if it happened?

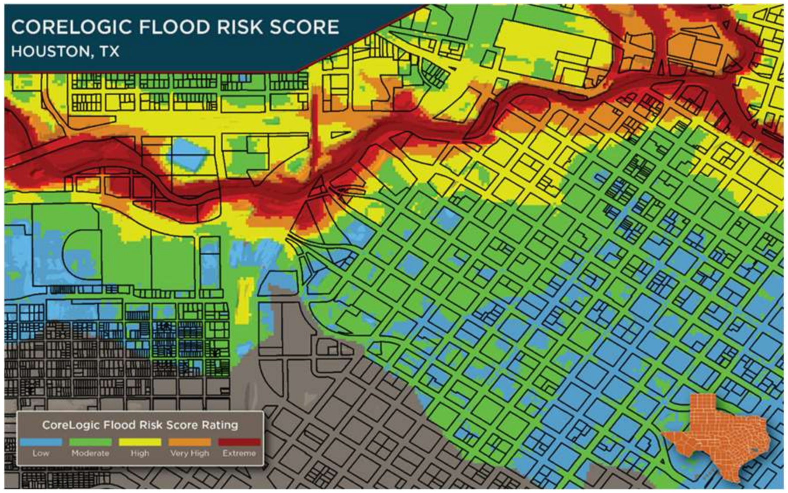


FORENSIC

What did happen?

Deterministic Models

- Provides a score (1-100) that represents the relative risk for a specific peril, at a specific location
- May only be relative to the hazard/frequency of a damaging event, while some include a measure of estimated loss based on the structure present



Deterministic Models

Flood Risk Score example

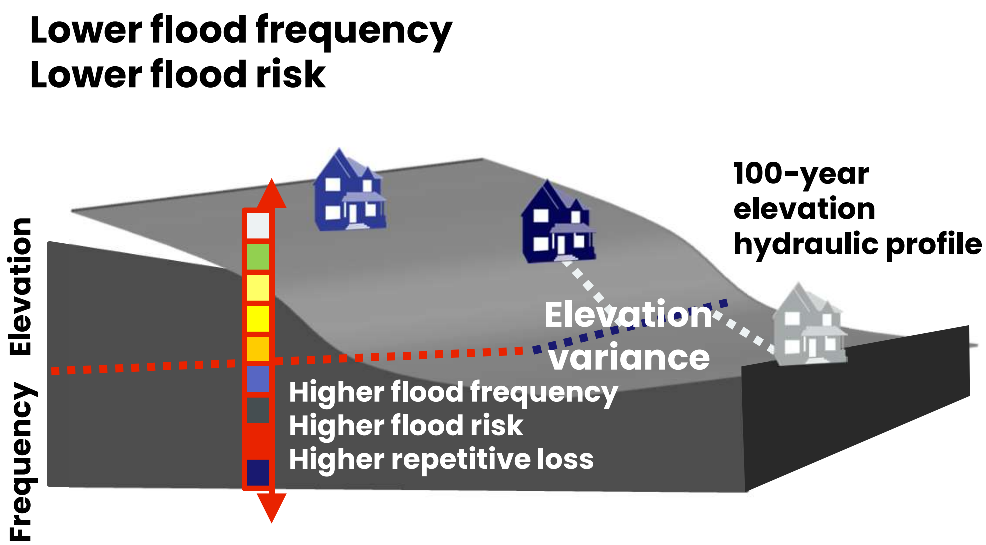
Create comprehensive spectrum of flood risk classifications

- Above/below 100-year flood elevation, up to 5,000-year flood event
- 10–100 score

Compare unknown (targeted property elevation) with known risk point (100-year flood elevation)

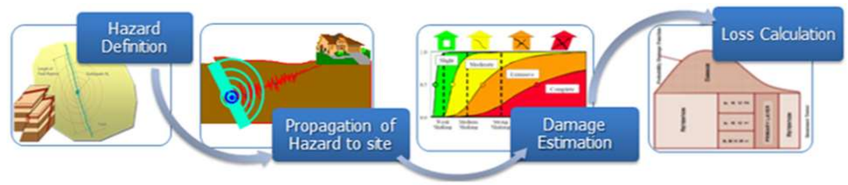
- Derive risk scores based on elevation variances (elevation difference between 100-year elevations and property elevations/first floor height)

The challenge: to build 100-year flood surface profile to cover national rivers, lakes, coastal zones and other water bodies



Probabilistic Models

- Start with a large event set (historical and simulated); each event has a frequency of occurrence
- Based on characteristics of the event at any location, the structure vulnerability and associated loss can be calculated



Event Catalog:
- Magnitude
  - How Big?
- Frequency
  - How Likely?
- Where?

Event Footprints:
- Ground Motion Distribution
- How Intense?
- Attenuation Functions
- Soil Maps
- Site Adjustments

Vulnerability:
- Construction
- Occupancy
- Coverage
- Sub-Peril (Shake, Fire, Sprinkler, tsunami)
- Demand Surge

Losses:
- Policy Terms
- Validation
- LAE, other adjustments

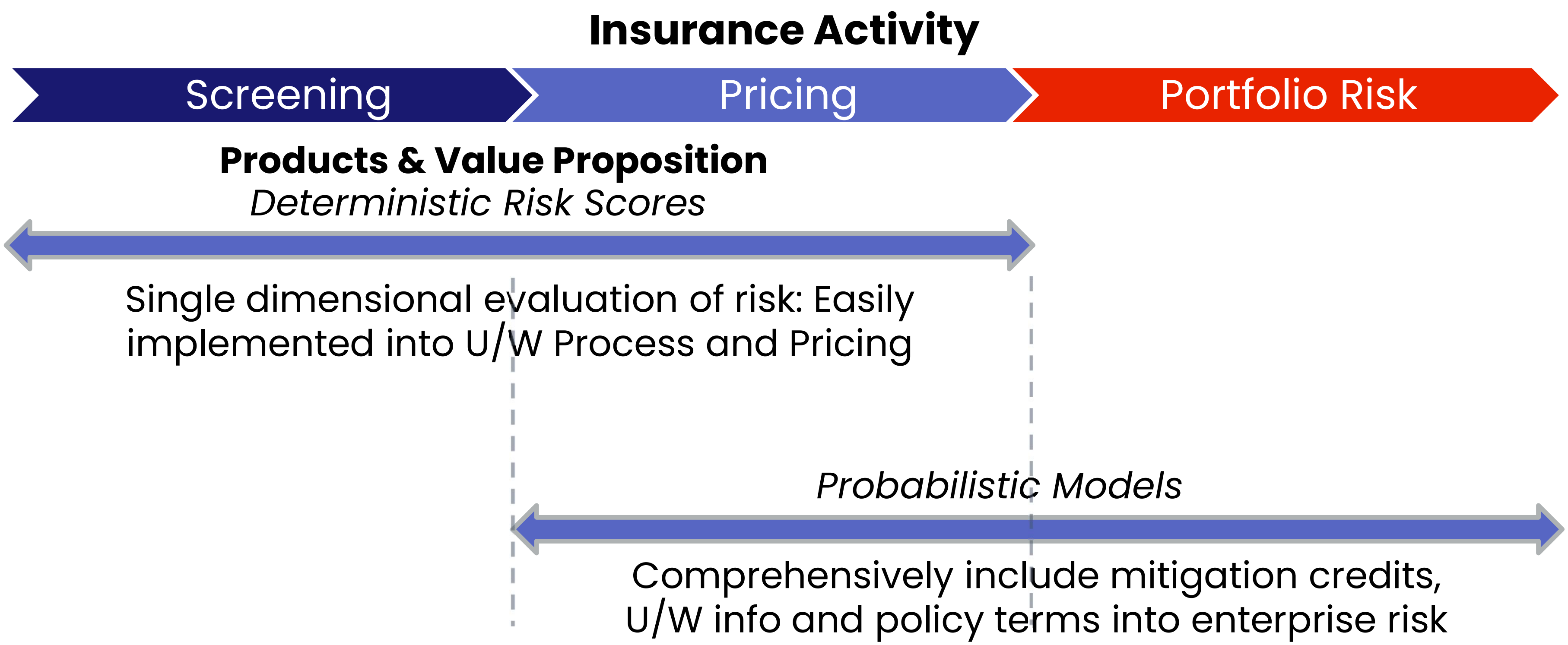
Probabilistic Models

Range of information provided

- Outputs include:
  - Event Loss tables and Yearly Loss tables
  - Average Annual Loss (AAL's) – the expected loss per year (average of all simulated years)
  - Standard Deviation of AAL (sometimes used as a risk load along with AAL for pricing)
  - Probable Maximum Loss (PML's) – the loss expected at a given frequency (i.e. 100 year PML – 1% frequency)
  - Tail Value at Risk (TVaR) – average of all losses that could happen beyond a given frequency (average of the top 1% losses)

Natural Catastrophe Offerings to Insurers/Reinsurers

A Complete Suite of Products to Cover the Insurers' Needs



Uniqueness of various perils – Secondary Perils

Smaller Footprint catastrophes

- Potentially more frequent
- Smaller geographic area affected
- Historical event experience is included when modeling the potential for future events
  - Hail

Uniqueness of various perils

Locational Accuracy

- Larger footprint events may not require the same level of locational granularity as smaller footprint events

- Most perils require accurate location / geocoding to ensure the best answer from the model
  - Flood (elevation changes)
  - Wildfire (distance to high risk vegetation)

Developing Hail Risk: Base Data Layers

- **Hail Report Based**

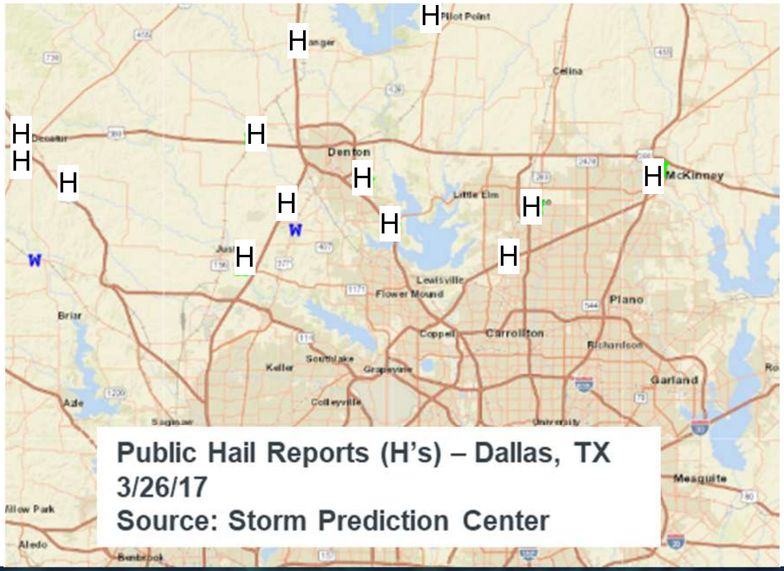
  Deliverable: Frequency of hail events in County or Zip Code

  - Can estimate the frequency of an event but not the hail size breakdown within the event (A 1.5” hail event occurs in Dallas County every 1.5 years)

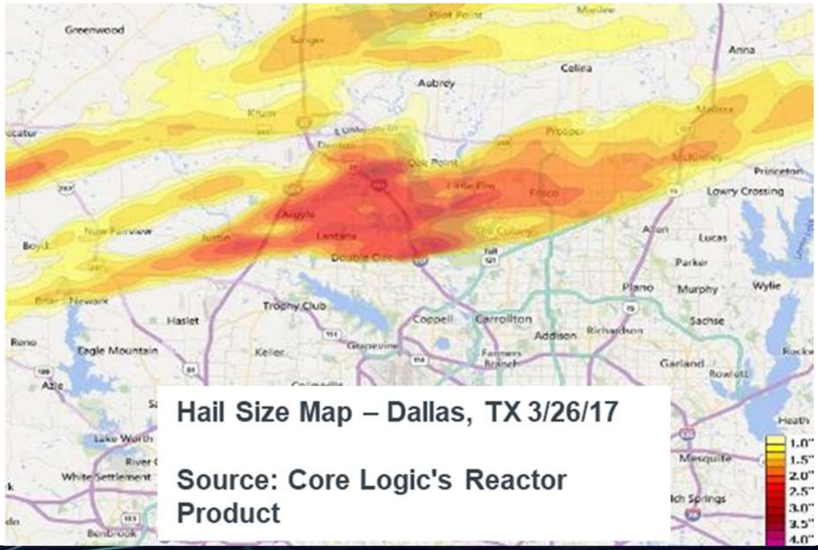
- **Hail Footprint Based**

  Deliverable: Frequency of observed hail size at property

  Can estimate the hail-size specific frequency of hail events (This property is expected to be hit by *at least* 1.5” hail every 15)



Public Hail Reports (H’s) – Dallas, TX 3/26/17
Source: Storm Prediction Center



Hail Size Map – Dallas, TX 3/26/17

Source: Core Logic's Reactor Product

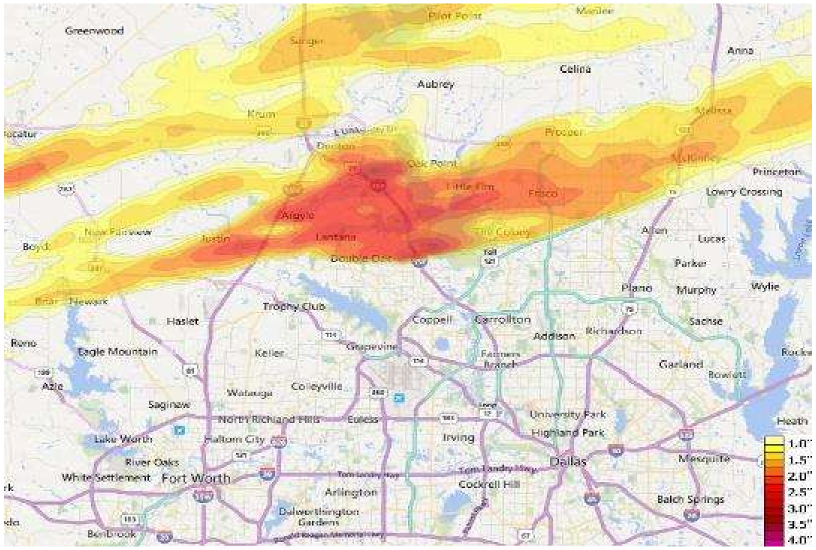
Developing Hail Risk: Hail Footprint Granularity

- **Hail Footprint Based**

  Deliverable: Frequency of observed hail size at property

  - Realistic, high-resolution hail footprints derived from proprietary radar-based weather forensic algorithm from CoreLogic
  - Granularity is improved by 5-6x over using reports

- **Hail Footprint Statistics Dallas Hailstorm**
  - Dallas Area: 200 sq miles
  - 1-1.25” : 20 sq miles (10% of land)
  - 1.25-1.5” : 10 sq miles (5% of land)
  - 1.5”-1.75”: 3 sq miles (2% of land)
  - 1.75”-2.0”: 3 sq miles (1% of land)
  - +2.0”: 1 sq miles (0.5% of land)



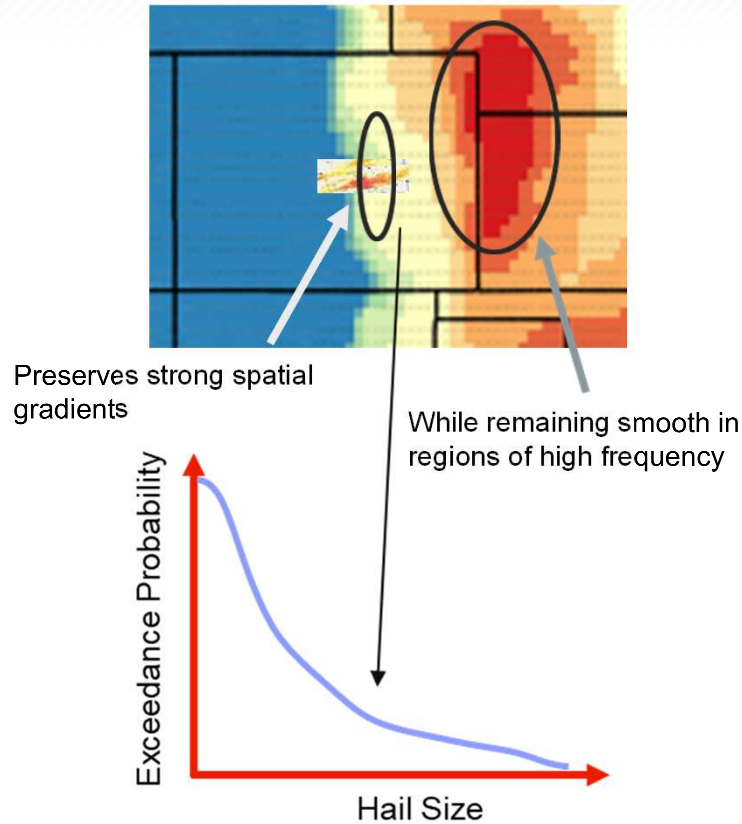
Hail Size Map – Dallas, TX 3/26/17

Source: Core Logic's Reactor Product

Developing Hail Risk from Footprints

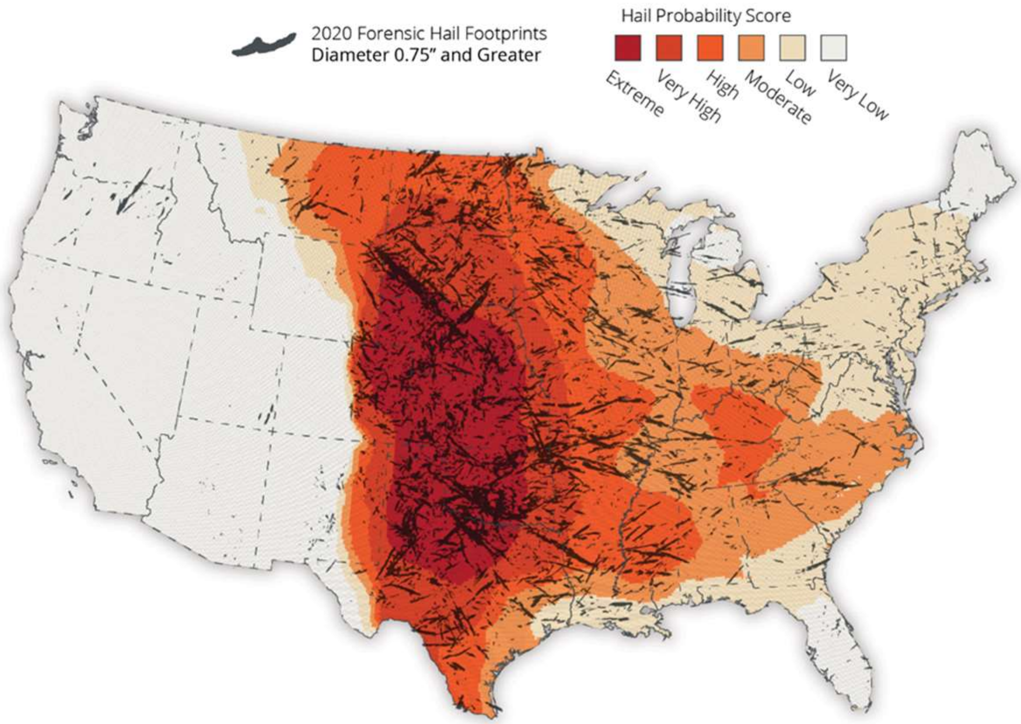
Steps to create an EP Curve

- Footprint Catalog
  - 2009-2016 hail footprints based on CoreLogic Hail Verification Technology
- Smooth Historical Footprints
  - **Environment-Conforming Smoothing:** Identifies regions with strong but physical gradients in storm behavior, while also sufficiently smoothing in regions with naturally high variability
    - SPC (Storm Prediction Center) hail reports, 1950-2016
    - NARR (North American Regional Reanalysis) daily historical environmental data 1979-2016
    - Combine frequency of environments and reports to create zones of homogenous hail storm frequency and behavior



Hail Risk across the Contiguous USA

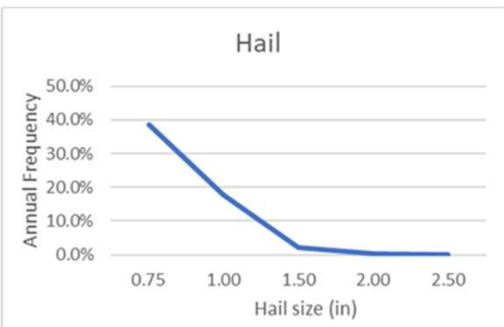
Figure 1: Nationwide Hail Risk

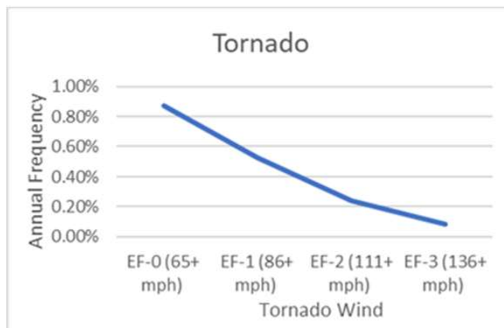


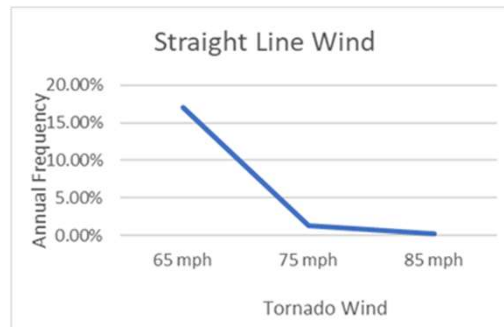
Source: CoreLogic

Exceedance Probability (EP) curve examples

lat	33.00000						
lon	-97.00000						
North Texas							
	Hail		Tornado	Tornado		Straight Line	SLW
Hail size	annual freq		Wind	annual freq		Wind	annual freq
0.75	38.5%		EF-0 (65+ mph)	0.87%		65 mph	17.01%
1.00	17.8%		EF-1 (86+ mph)	0.52%		75 mph	1.26%
1.50	2.3%		EF-2 (111+ mph)	0.24%		85 mph	0.20%
2.00	0.3%		EF-3 (136+ mph)	0.08%			
2.50	0.1%						







Questions?