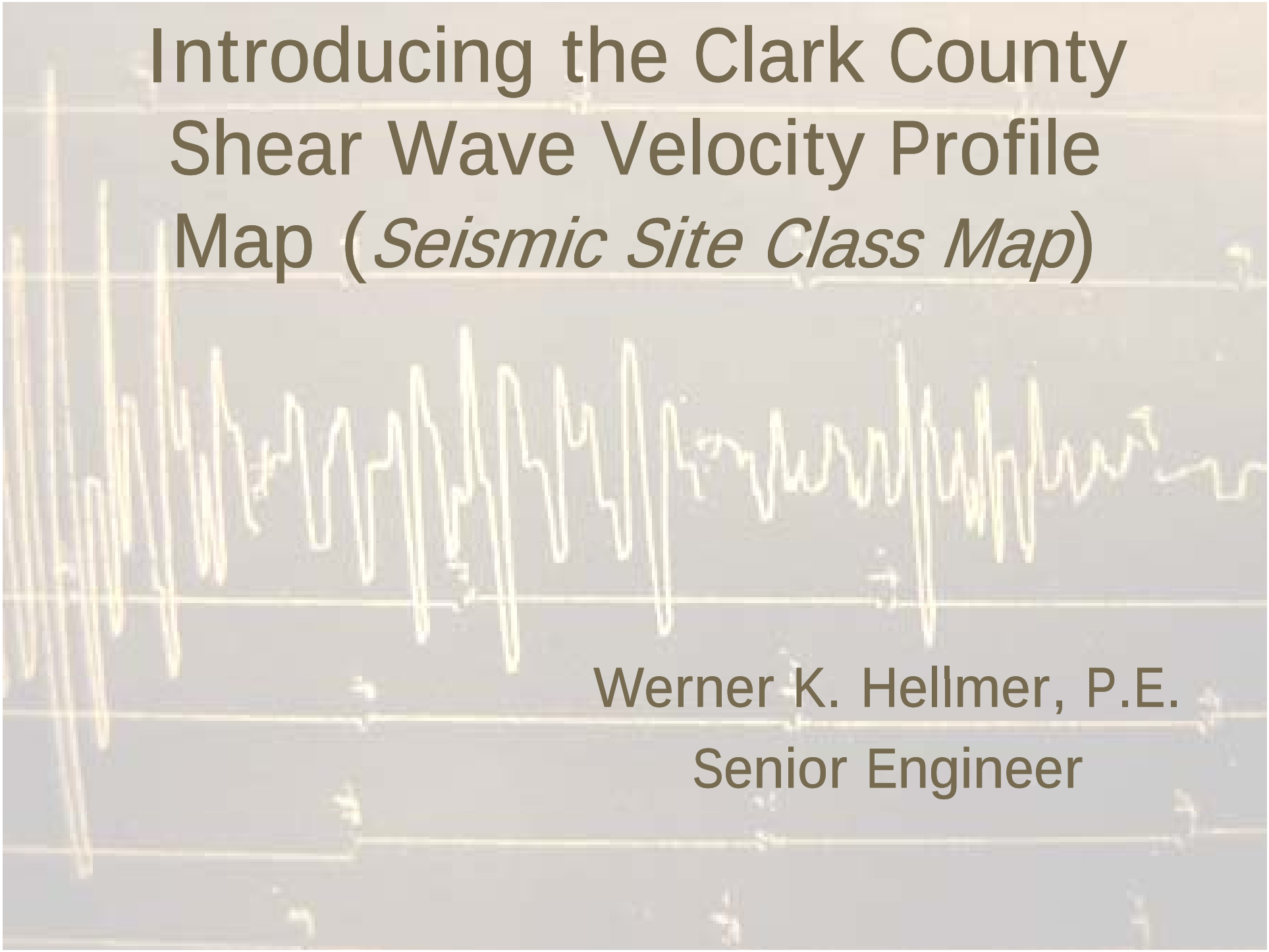
Introducing the Clark County Shear Wave Velocity Profile Map (*Seismic Site Class Map*)



Werner K. Hellmer, P.E.
Senior Engineer

Why do we care about Site Class?

- 2009 IBC Chapter 16 Structural Design
  - Section 1613 Earthquake Loads
    - 1613.1 **Every structure**, and portion thereof, **including non-structural components** that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with ASCE 7, excluding chapter 14 and appendix 11A. The *seismic design category* for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

What is Site Class?

One of three components used to determine Seismic Design Category (SDC):

1. Seismic Site Class
2. Design Spectral Accelerations provided by NEHRP (easily determined by USGS maps or IBC maps)
3. Occupancy Category (Table 1604.5).

Seismic Design Category (SDC)

- The SDC directly impacts the amount of seismic force that structures and non-structural components are required to resist
- The SDC determines the required level of seismic detailing
- SDC is determined from 2009 IBC Section 1613.5.6.

What is Site Class?

The Simplistic Approach

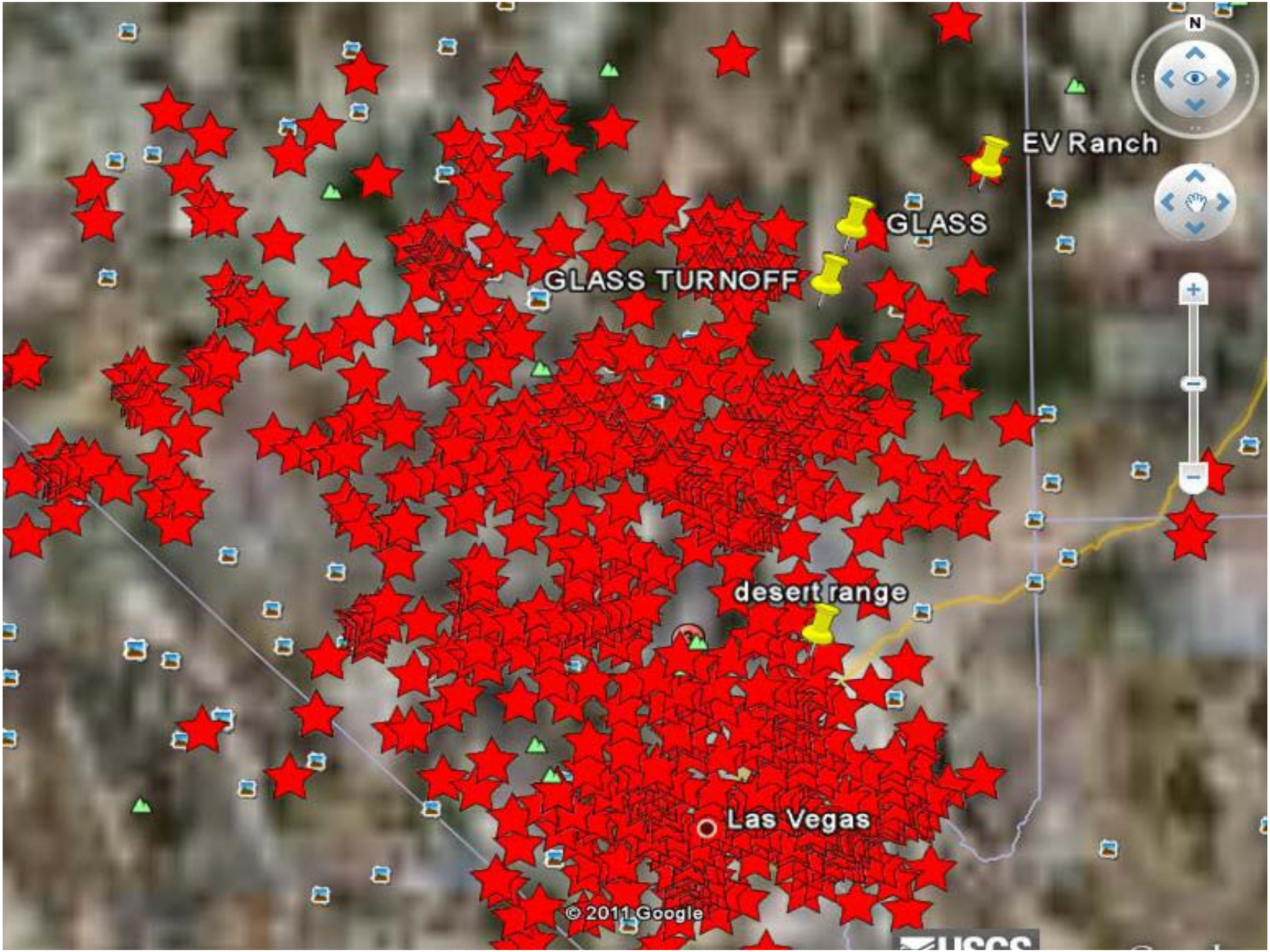
- The earth (rock/plates) move first
- This motion radiates outward through rock and this energy is imparted to the ground surface
- The ground surface imparts this motion to the structure
- The structure imparts this motion to its contents

What is Site Class?

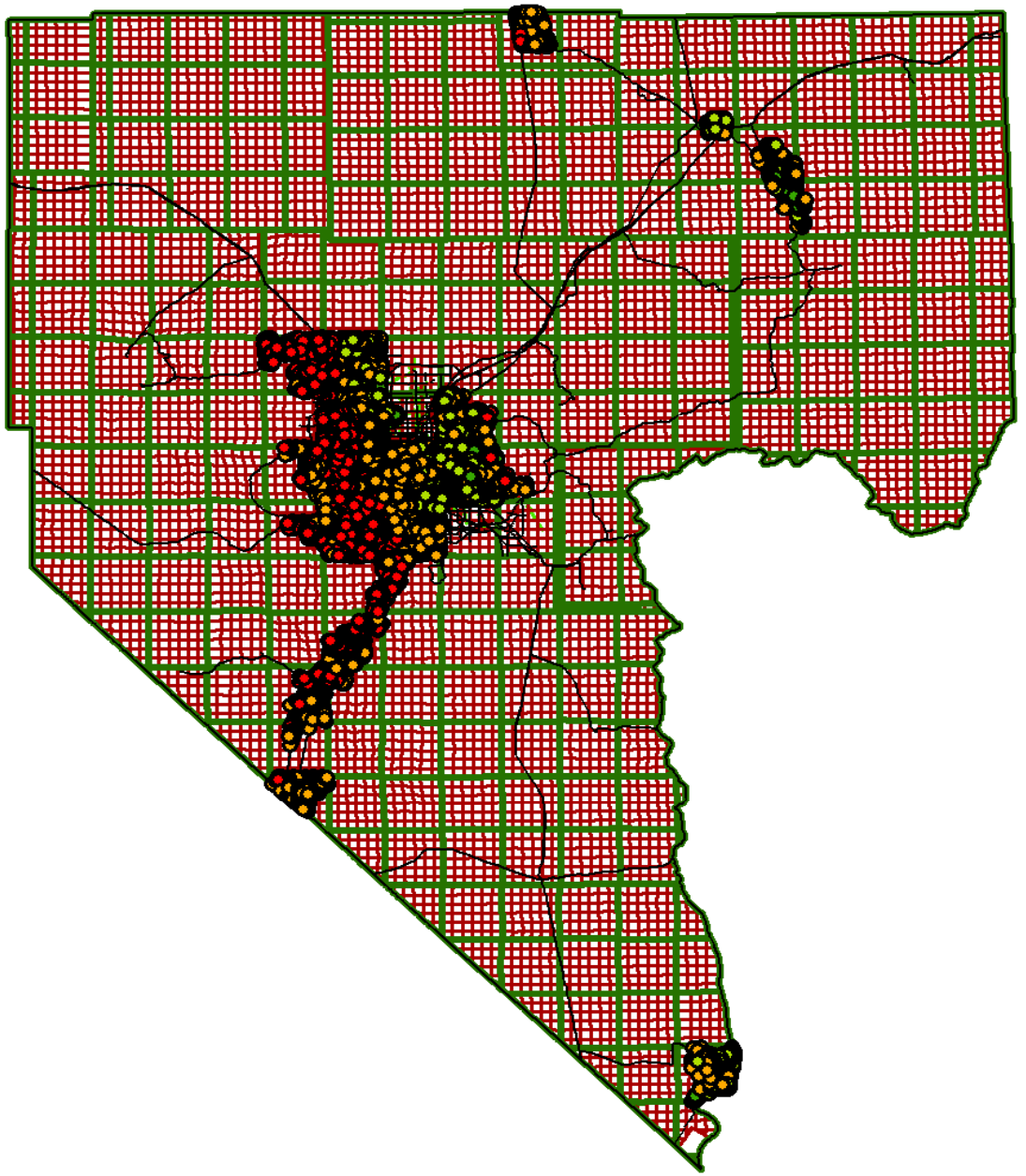
- Soil stiffness (spring analogy)
- Spectral Accelerations represent pre-defined probabilistic seismic hazards
- Site Class addresses site specific modifications (amplification/attenuation) imparted to the baseline Spectral Accelerations; think Northridge and Mexico City

The Map as a Project

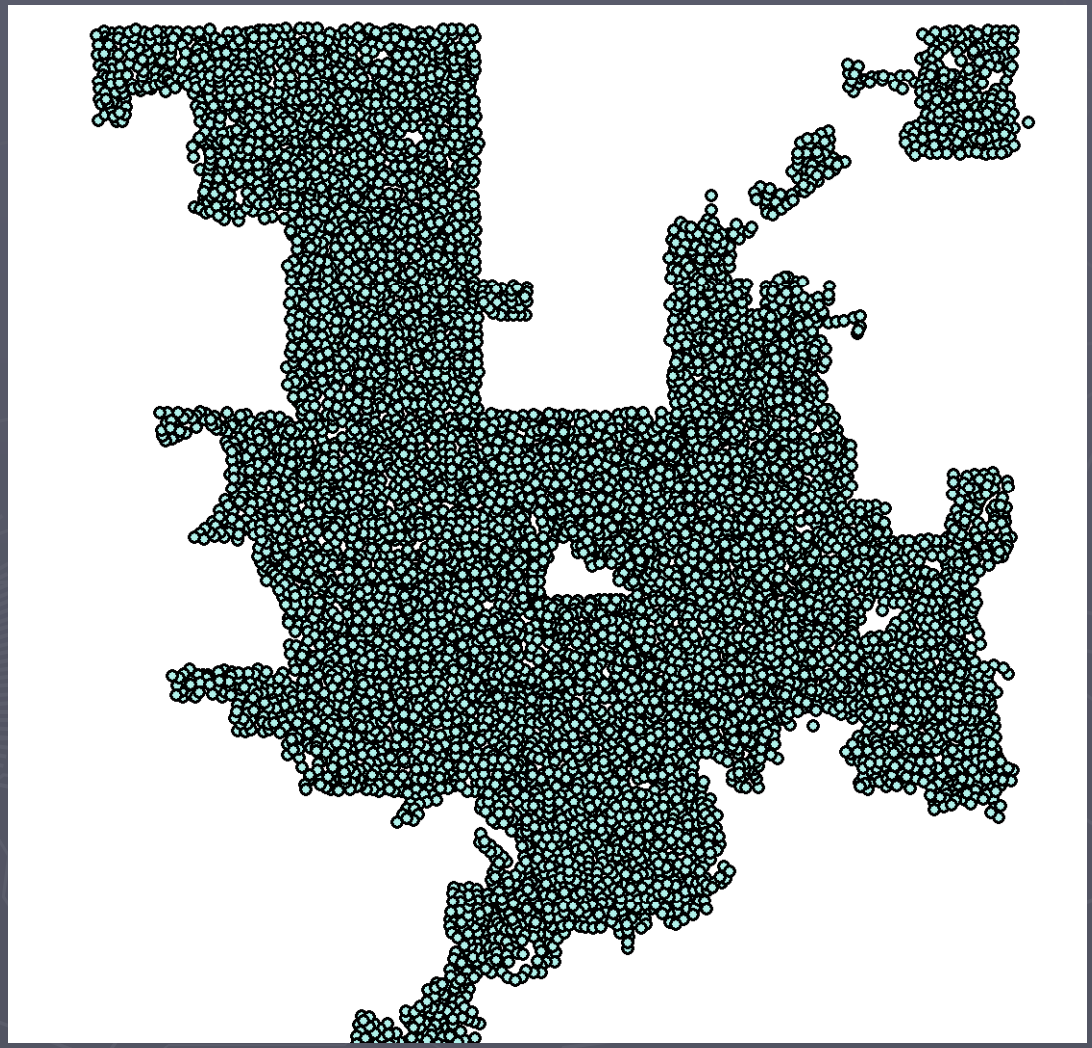
- Gather test data across areas of interest
- QC evaluation of data
- Generate Map surface models
- QC evaluation of alternate models
- Select model and produce Map


N
EV Ranch
GLASS
GLASS TURNOFF
desert range
Las Vegas
© 2011 Google

Early Beginnings

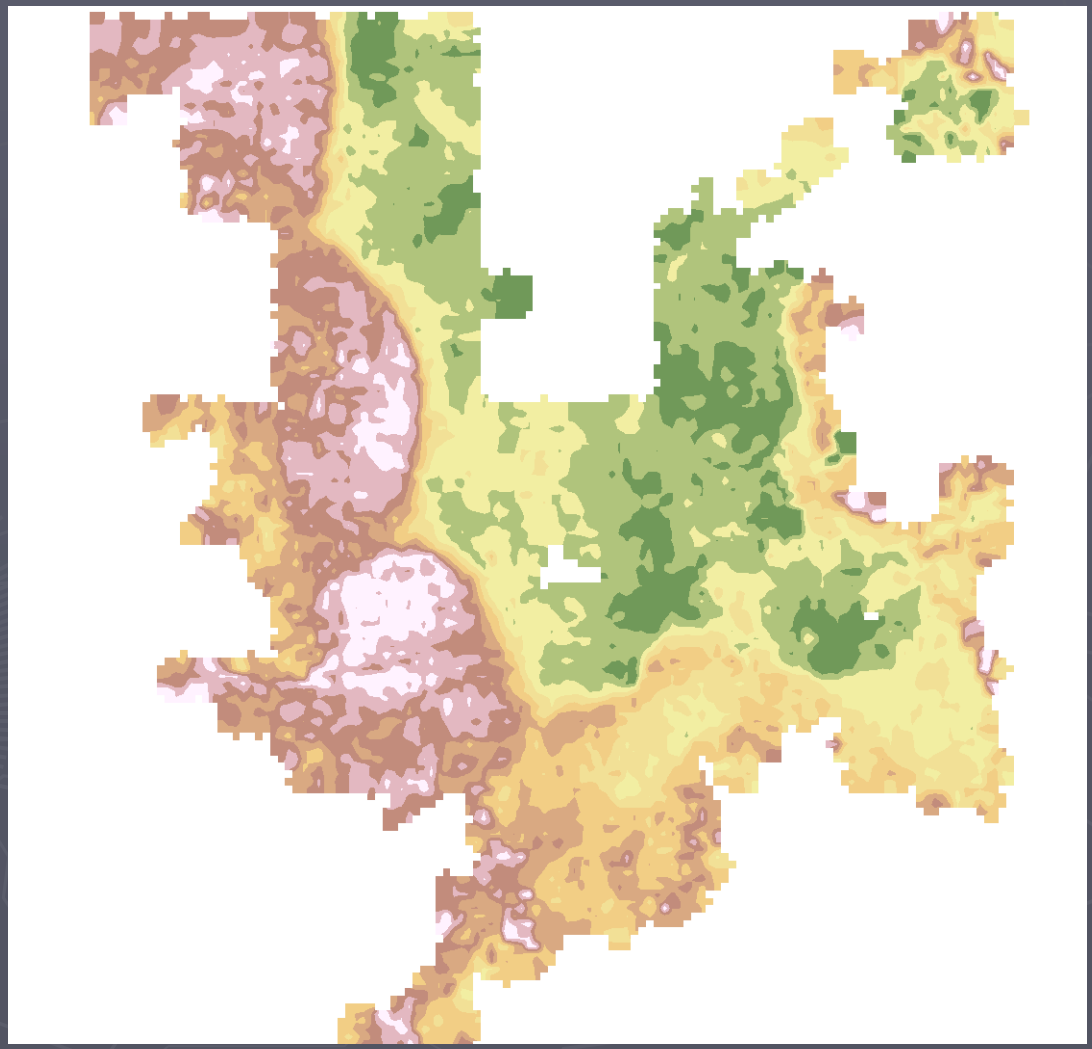


Raw Data

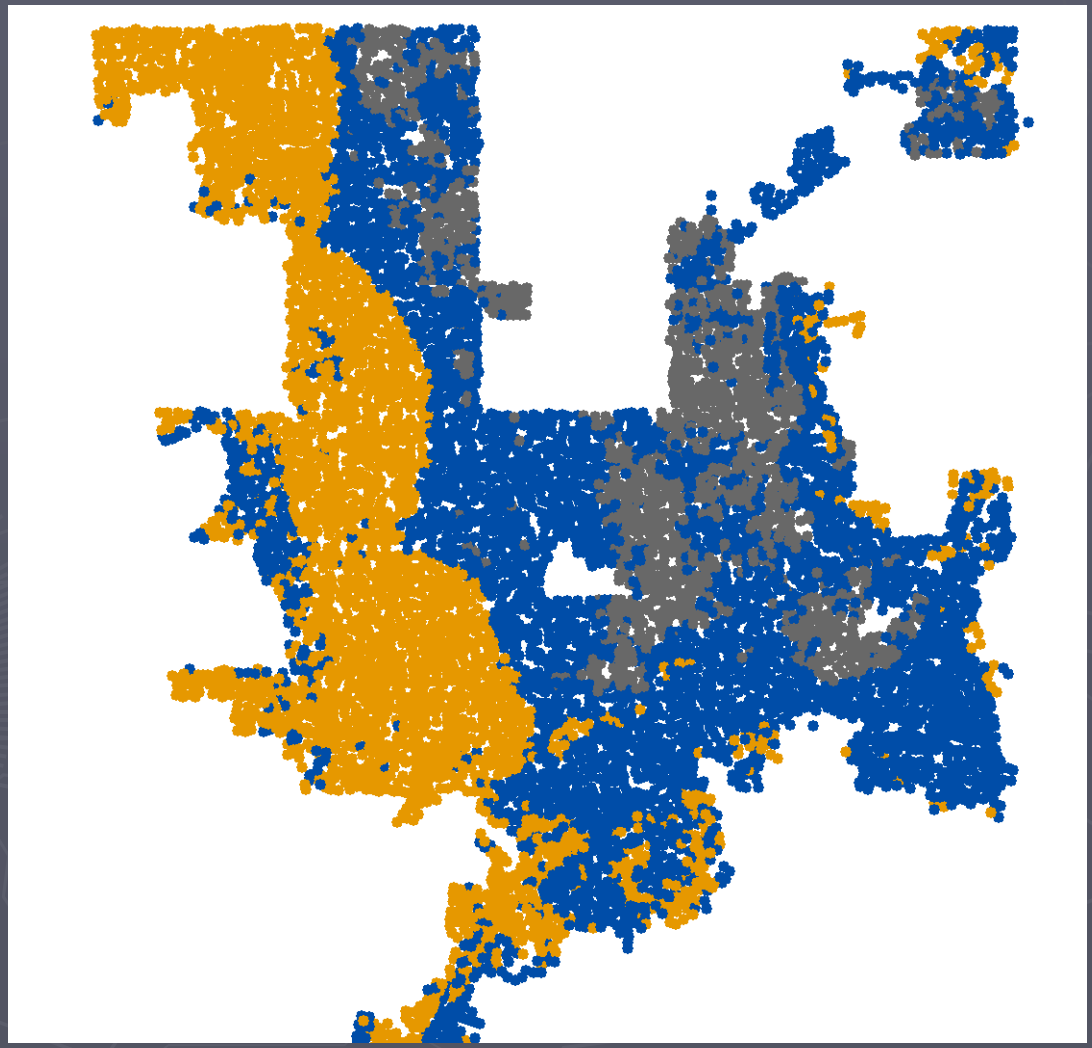


Natural Classed Data

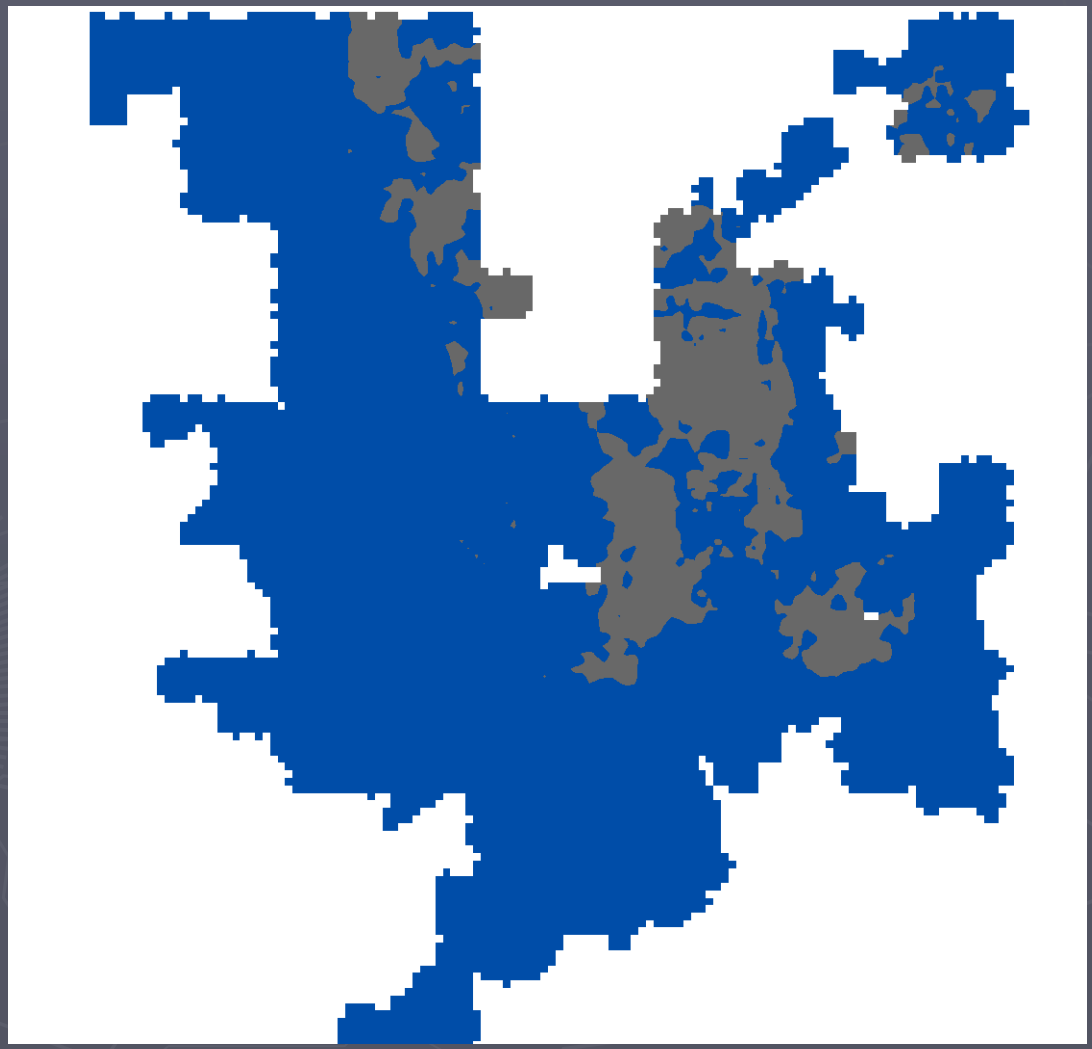
Natural Surface Model



Code Classed Data



Code Classed Surface Model



Code Classed Surface Model Variance

OpenWeb InfoMapper

- http://www.clarkcountynv.gov/
- On left side of main window there is a menu bar labeled Quick Look-up; select “I Want To…” then choose Map
- When the next window opens select OpenWeb
- Select the Go To OpenWeb link
- Accept the data disclaimer

OpenWeb Infomapper

- You are now in the OpenWeb application
- Select the Display Options button
- The left uppermost button allows you to select which map to project; select Seismic
- This is the CCSWVPM
- Select the Resources button then select the Show Legend button

Using the CCSWVPM

- Medium Blue represents seismic site class C (V_{30}>1200ft/sec)
- Grey represents seismic site class D (V_{30}<1200ft/sec)
- No occurrences of V30<600ft/sec were identified during testing

Using the CCSWVPM

- C/D transition areas should default to D when using the map (a single structure can only have one SDC)
- Large sites that contain a transition should clearly reference which seismic site class applies to each area
- Use of mapped site class values may not be appropriate for deep cuts and/or fills
- DO NOT EXTRAPOLATE outside of map limits

Structural and Nonstructural

- Back to the Code- 2009 IBC Section 1613 (don’t forget modifications)
- Building Structure Seismic Load requirements- ASCE 7-05 Chapter 12
- Nonstructural Component Seismic Load requirements- ASCE 7-05 Chapter 13
- Nonbuilding Structure Seismic Load requirements- ASCE-7-05 Chapter 15

Benefits of Improved SDC for Design of Building and Nonbuilding Structures

- Lower seismic demand (loads)
- Fewer restrictions on Seismic Force-Resisting Systems
- Generally less stringent seismic detailing requirements (i.e. lower design and construction costs)

Benefits of Improved SDC for Design of Nonstructural Components

- Lower seismic demand (loads)
- Generally less stringent seismic detailing requirements and potential exemptions (i.e. lower design and construction costs)

ASCE 7-05 Chapter 13

- 13.1.2 SDC
- 13.1.3 Importance Factor I_p (1.0 or greater)
- 13.1.4 Exemptions
- Please be aware of and check for numerous errata: http://www.asce.org/Codes-and-Standards/Errata/

13.1.4 Exemptions

- Item 3 Mechanical and Electrical Components in SDC C and I_p =1.0,
- ALL Non Structural component exemptions *subject to limitations in 13.2.3 Consequential Damage… i.e. the non-essential component can not cause failure of an essential component.*
- Exemption does not mean bubble gum and duct tape are OK, other code requirements still remain in effect

13.4 Nonstructural Component Anchorage

- ...Component attachments shall be bolted, welded or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity. A continuous load path of sufficient strength and stiffness between component and supporting structure shall be provided...
- 13.4.6 Friction clips shall not be used for anchorage attachment.

Questions?
Thank You
N
NW
NE
E
S
SE