SEISMIC CHARACTERISTICS OF PRE-1980 HIGH-RISE CONCRETE BUILDINGS IN VANCOUVER

By Jeff Yathon

Supervised by Dr. Adebar and Dr. Elwood

Introduction - Motivation

1. Non-ductile Concrete Buildings – Global Issue
   - Higher risk of severe damage or collapse
   - Major first step is to build inventories
   - Example: Concrete Coalition in California

2. How bad are the Vancouver buildings?
   - Local engineers and building officials are becoming more aware and concerned

Introduction – History c. 1930

Introduction – History c. 1970

Introduction – History c. 2007

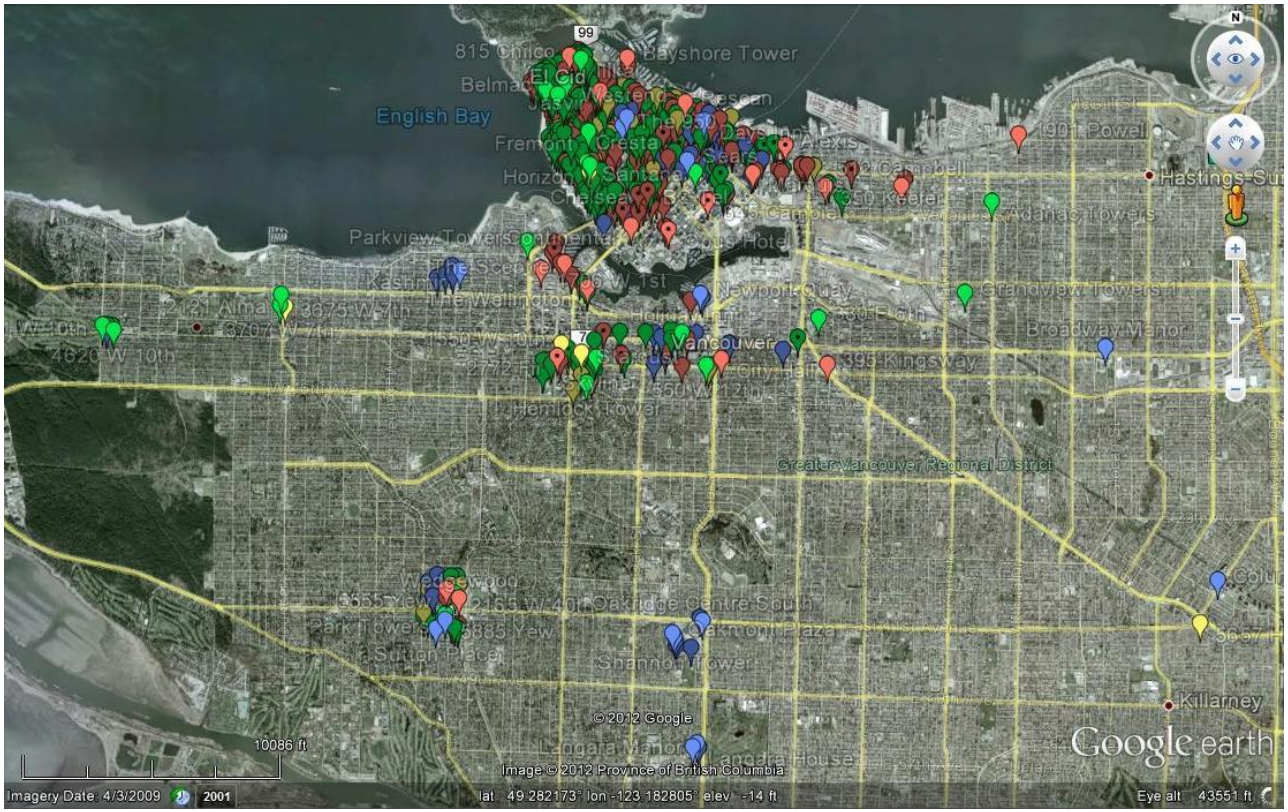
Introduction – Objectives

- Vancouver building characteristics
  - Many high-rise concrete buildings
  - Most use concrete walls as SFRS

- Scope of project:
  - 7 storeys or taller
  - Designed before 1980
  - Detailed information

What we have

- Drawings of ~350 buildings (about 70% of total)

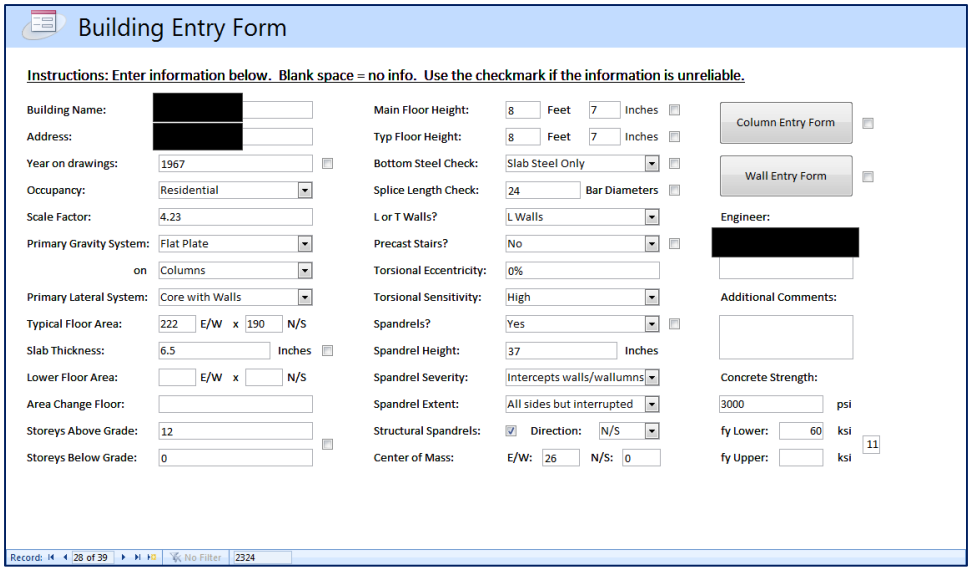


Making a Database

Building Entry Form

- Column Entry Form
- Wall Entry Form

- Building information
  - Basic information
  - Deficiencies

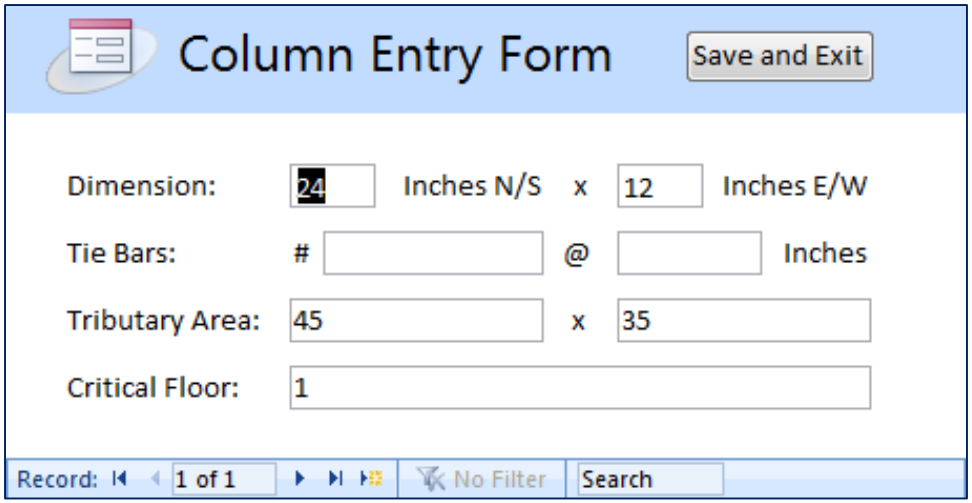


Making a Database

Building Entry Form

- **Column Entry Form**
- **Wall Entry Form**

- Column information
  - Most critical column
  - Ties and tributary area



Making a Database

Building Entry Form

Column Entry Form

Wall Entry Form

- Wall information
  - Dimensions and reinforcement
  - Discontinuities

Wall Entry Form

Save and Exit

Wall Number	Wall Floor	Length	Thickness	EWDistance	NSDistance	Orientation	AttachedTo	CoupledTo	BarSize	BarSpacing	Layers	TribArea1	TribArea2
1	3	26	8	-44	87	E/W			4	16	Single	55	18
2	3	14	8	-32	95	N/S	1		4	16	Single	55	10
3	3	26	8	97	87	E/W			4	16	Single	55	18
4	3	14	8	84.5	95	N/S	3		4	16	Single	55	10
5	3	26	8	-44	-87	E/W			4	16	Single	55	18
6	3	14	8	-32	-95	N/S	5		4	16	Single	55	10
7	3	26	8	97	-87	E/W			4	16	Single	55	18
8	3	14	8	84.5	-95	N/S	7		4	16	Single	55	10
9	3	16	8	-83.5	63	N/S			4	16	Single	35	29
10	3	16	8	136	63	N/S			4	16	Single	35	29
11	3	16	8	-83.5	-63	N/S			4	16	Single	35	29
12	3	16	8	136	-63	N/S			4	16	Single	35	29
13	3	56	8	26	29	E/W			4	16	Single	24	95
14	3	62	8	26	4.5	E/W			4	16	Single	17	95

Record: 1 of 14 No Filter Search

Basic Statistics

- Percentage of buildings with walls as the SFRS:

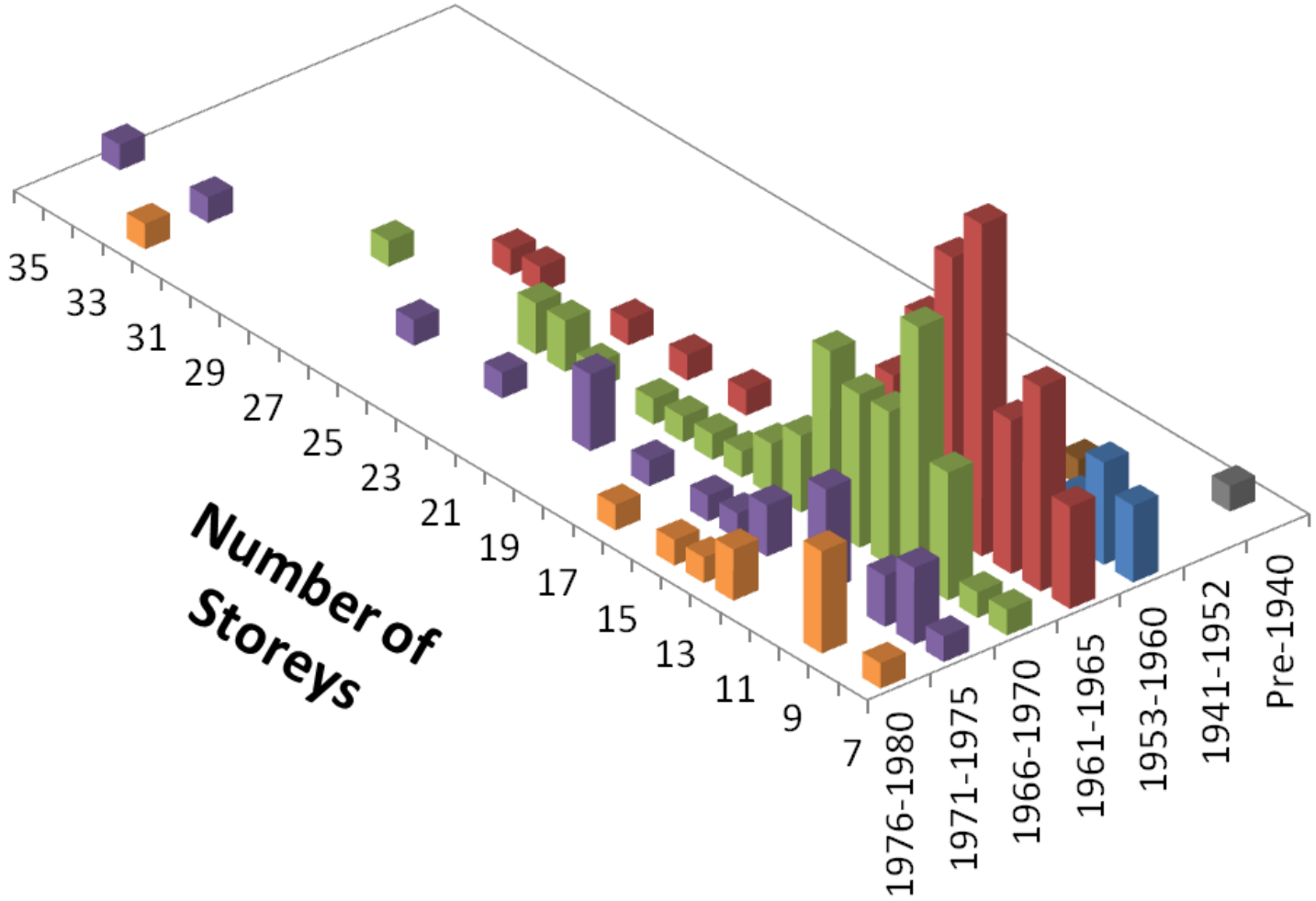
98%

- Percentage of residential buildings:

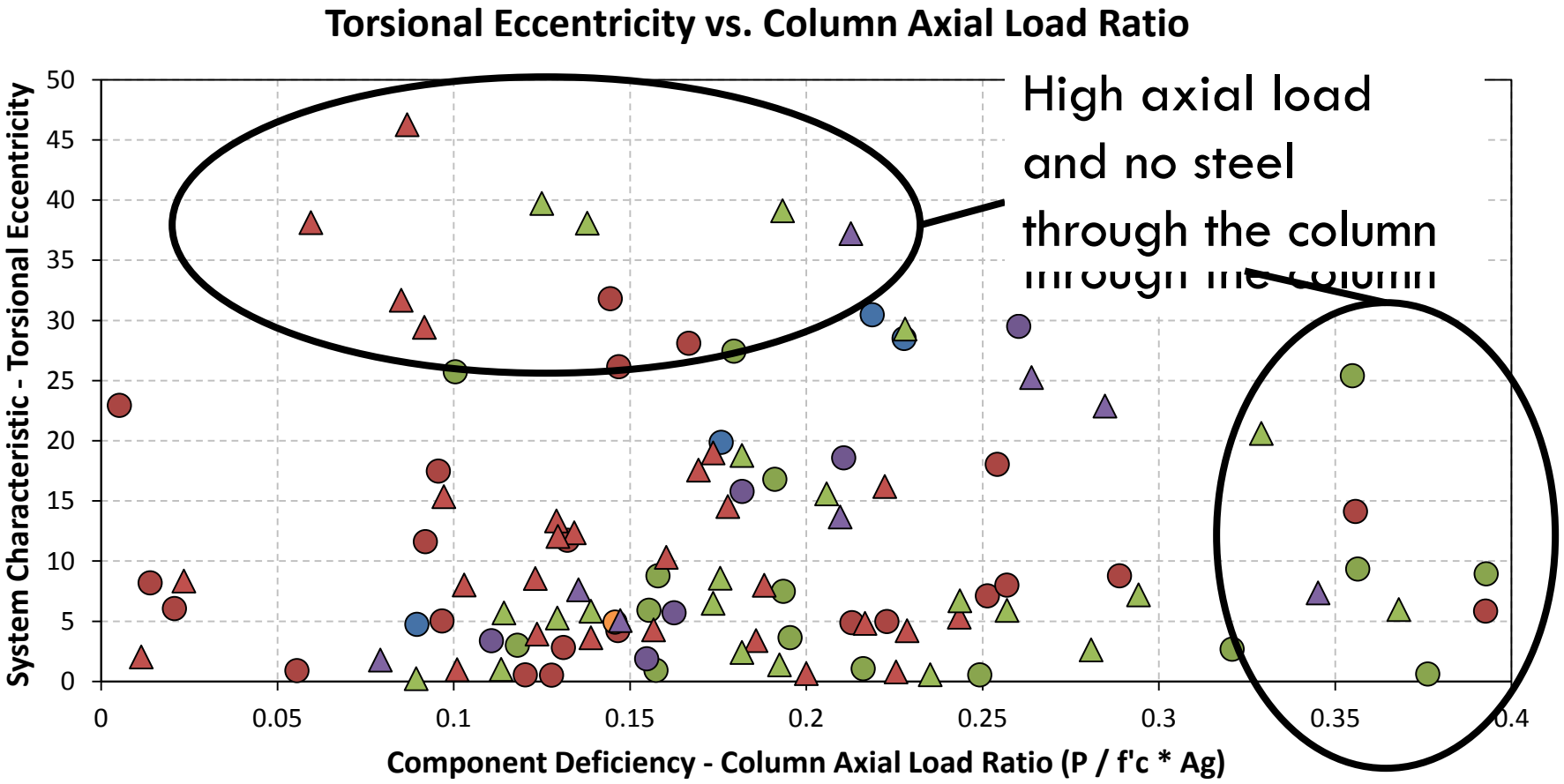
85%

(Only 11% office)

Basic Statistics

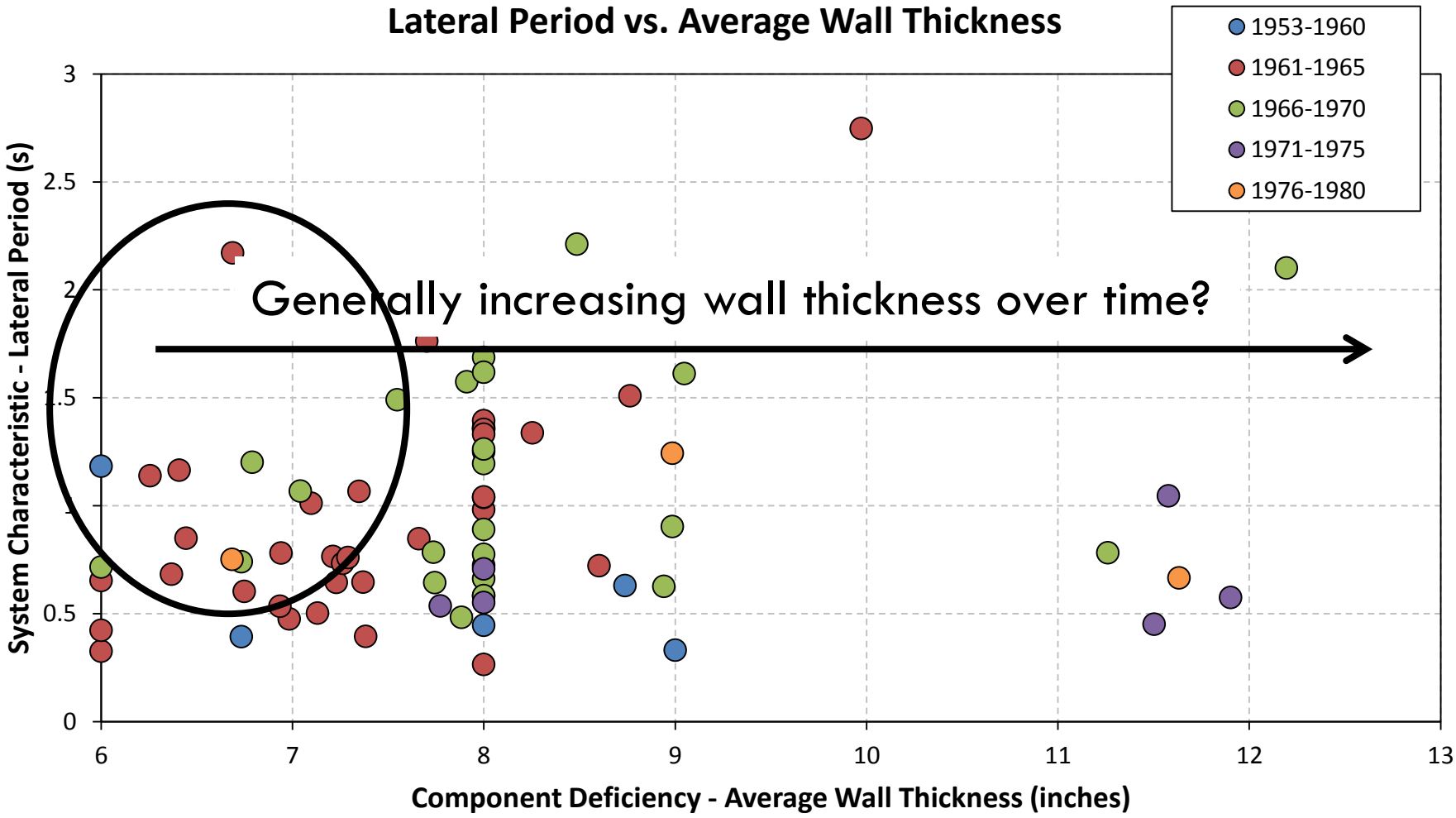


Calculated Statistics

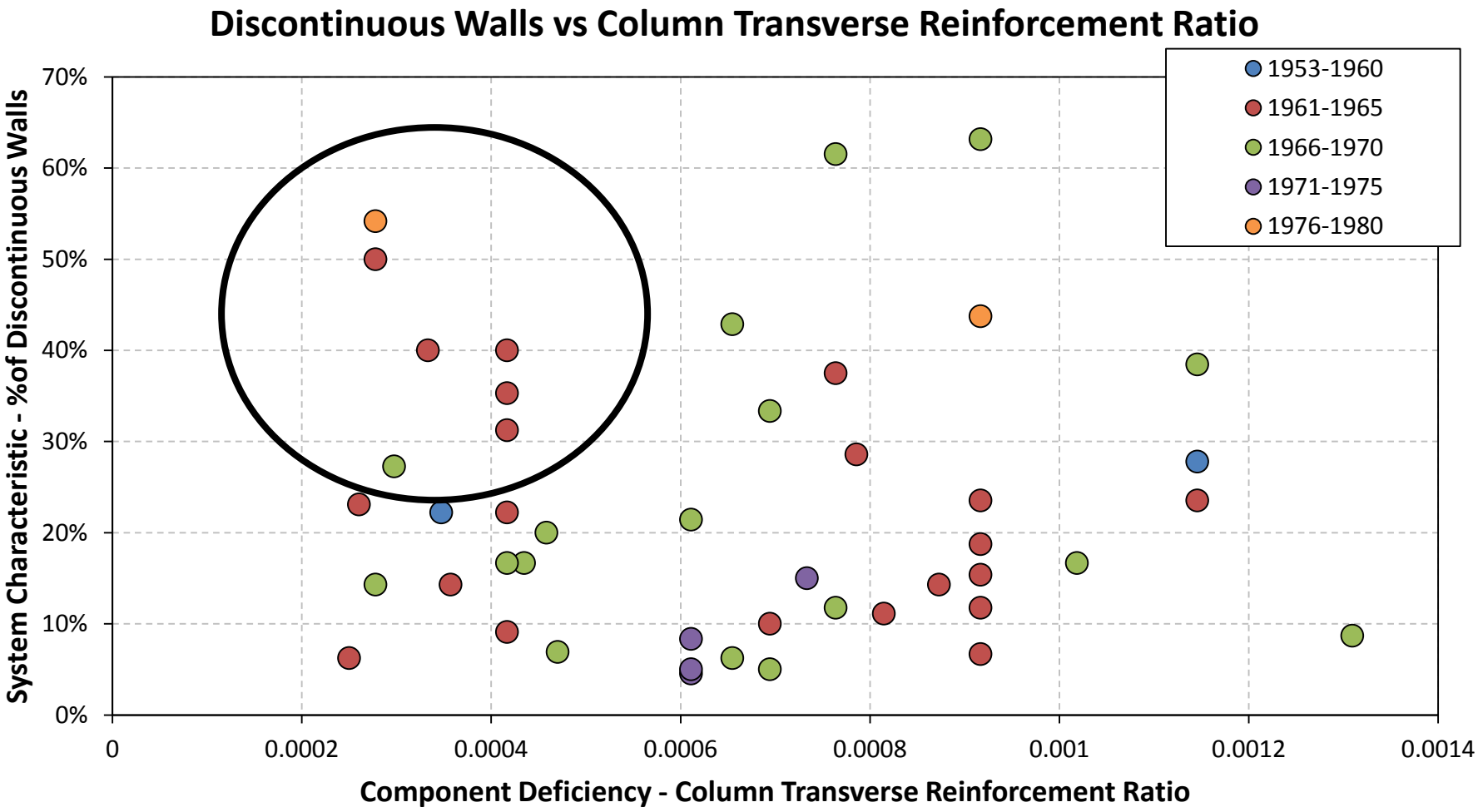


Circle = No steel through column Triangle = Slab steel through column

Calculated Statistics



Calculated Statistics



Future Research

- Using database to generate more statistics
  - Strength and stiffness calculations are being refined
  - Continue to generate plots
  - Examine the possibility of multiple system or component deficiencies

Future Research

- Using database information for specific problems
  - Identifies realistic ranges of variables
  - E.G. Thin walls, pier-spandrel systems
- Development of archetype buildings
  - Can be used in hazard models
  - Global assessment of the system

Thank you!

Any questions?