#### OCE 496: Senior Design II -Outline-

University of Rhode Island Kingston, Rhode Island May 1, 2014

## Contents

1	Intr	Introduction 4									
	1.1	Objectives	4								
		1.1.1 Phase One	4								
		1.1.2 Phase Two	4								
	1.2	Layout	4								
<b>2</b>	Fin	inite Element Model (FEM) 5									
	2.1	· · · · · · · · · · · · · · · · · · ·	5								
		2.1.1 Background of Claiborne Pell Bridge	5								
		2.1.2 Introduction of FEM	5								
	2.2		5								
		2.2.1 L Beam Analysis	5								
	2.3	v	5								
		g · · · · · · · · · · · · · · · · · · ·	5								
			5								
		2.3.3 Limitations of Abaqus FEM	5								
3	Inst	trumentation Package	6								
	3.1	<u> </u>	7								
	3.2		7								
		•	7								
		v -	7								
		1	7								
	3.3		7								
	0.0		7								
			7								
		9	7								
			7								
			7								
	3.4	9 9	7								
	0.1		7								
			7								
	3.5		7								
	3.6										
	0.0	9	7 7								
		3.6.2 Energy Servenging Potential	7								

		3.6.3	Battery Selection	7						
4	Dat	Data Collection 8								
	4.1	Phase	One Data Collection	8						
		4.1.1	6g Tri-Axial Accelerometer Data	8						
	4.2	Phase	Two Data Collection	8						
		4.2.1	6g Tri-Axial Accelerometer Data	8						
		4.2.2	1.5g Tri-Axial Accelerometer Data	8						
		4.2.3	Cell Phone Accelerometer	8						
		4.2.4	Battery Discharge Curve	8						
		4.2.5	Experimental Observed Efficiency	8						
5	Dat	Data Analysis								
	5.1 Phase One Data Analysis									
		5.1.1	Comparison of Preliminary Abaqus Model and Preliminary Data	9						
	5.2	Phase	Two Data Analysis	9						
		5.2.1	Comparison of Developed Abaqus Model with Literature	9						
		5.2.2	Comparison of Developed Abaqus Model with Developed Abaqus Model .	9						
6	Future Development 10									
	6.1	Instru	mentation	10						
		6.1.1	Integration of Strain Gauge	10						
		6.1.2	Wireless Transmission	10						
		6.1.3	GPS Time Synchronization	10						
		6.1.4		10						
	6.2	FEM		10						
		6.2.1		10						
		6.2.2	•	10						
7	Cor	nclusio	n	11						

## Introduction

- 1.1 Objectives
- 1.1.1 Phase One
- 1.1.2 Phase Two
- 1.2 Layout

# Finite Element Model (FEM)

- 2.1 Introduction
- 2.1.1 Background of Claiborne Pell Bridge
- 2.1.2 Introduction of FEM
- 2.2 Abaqus FEM Verification
- 2.2.1 L Beam Analysis
- 2.3 Claiborne Pell Bridge Model
- 2.3.1 Modeling Large Suspension Bridges
- 2.3.2 Model Process
- 2.3.3 Limitations of Abaqus FEM

### Instrumentation Package

$\mathbf{\Omega}$	-	т				- 1			. •		
~	.1		n	t٦	•		lu	C	t 1	<b>^</b>	n
·,	• ㅗ		11	υı	. U	AU.	LU		υı	u	411

- 3.2 Microprocessor
- 3.2.1 Necessary Specifications
- 3.2.2 Platform Options
- 3.2.3 Final Platform
- 3.3 Sensors
- 3.3.1 Accelerometer

**Necessary Specifications** 

**Sensor Options** 

**Sensor Selection** 

3.3.2 Strain Gauge

**Necessary Specifications** 

**Sensor Options** 

Sensor Selection

3.3.3 GPS Receiver

**Necessary Specifications** 

**Sensor Options** 

**Sensor Selection** 

- 3.3.4 CORS
- 3.3.5 Analog to Digital Converter

**Necessary Specifications** 

**Platform Options** 

- 3.4 Electronics Design
- 3.4.1 Circuitry

### **Data Collection**

- 4.1 Phase One Data Collection
- 4.1.1 6g Tri-Axial Accelerometer Data
- 4.2 Phase Two Data Collection
- 4.2.1 6g Tri-Axial Accelerometer Data
- 4.2.2 1.5g Tri-Axial Accelerometer Data
- 4.2.3 Cell Phone Accelerometer
- 4.2.4 Battery Discharge Curve
- 4.2.5 Experimental Observed Efficiency

## Data Analysis

- 5.1 Phase One Data Analysis
- 5.1.1 Comparison of Preliminary Abaqus Model and Preliminary Data
- 5.2 Phase Two Data Analysis
- 5.2.1 Comparison of Developed Abaqus Model with Literature
- 5.2.2 Comparison of Developed Abaqus Model with Developed Abaqus Model

## Future Development

- 6.1 Instrumentation
- 6.1.1 Integration of Strain Gauge
- 6.1.2 Wireless Transmission
- 6.1.3 GPS Time Synchronization
- 6.1.4 Package Assembly

Fabrication of Circuit Board

**Battery Integration** 

Package Enclosure

Power Management

**Package Location** 

- 6.2 FEM
- 6.2.1 Model Improvements
- 6.2.2 Dynamic Loading

# Conclusion