

## Introduction, Review, and Overview

**Understanding ASTM International Test Procedures  
for Cement and Concrete - Staying Up to Standard**

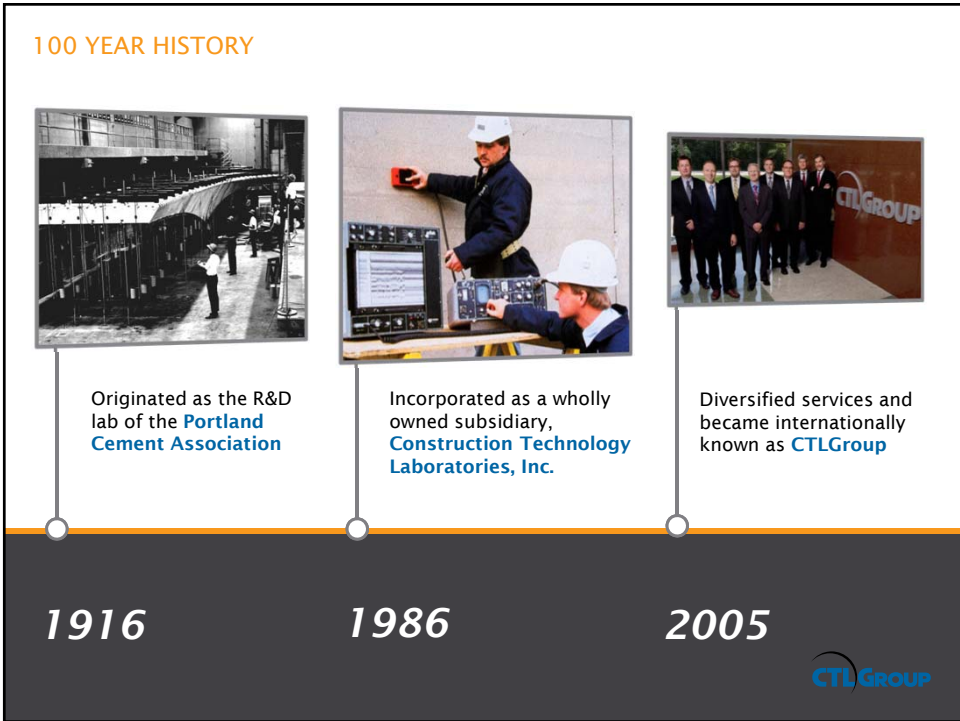
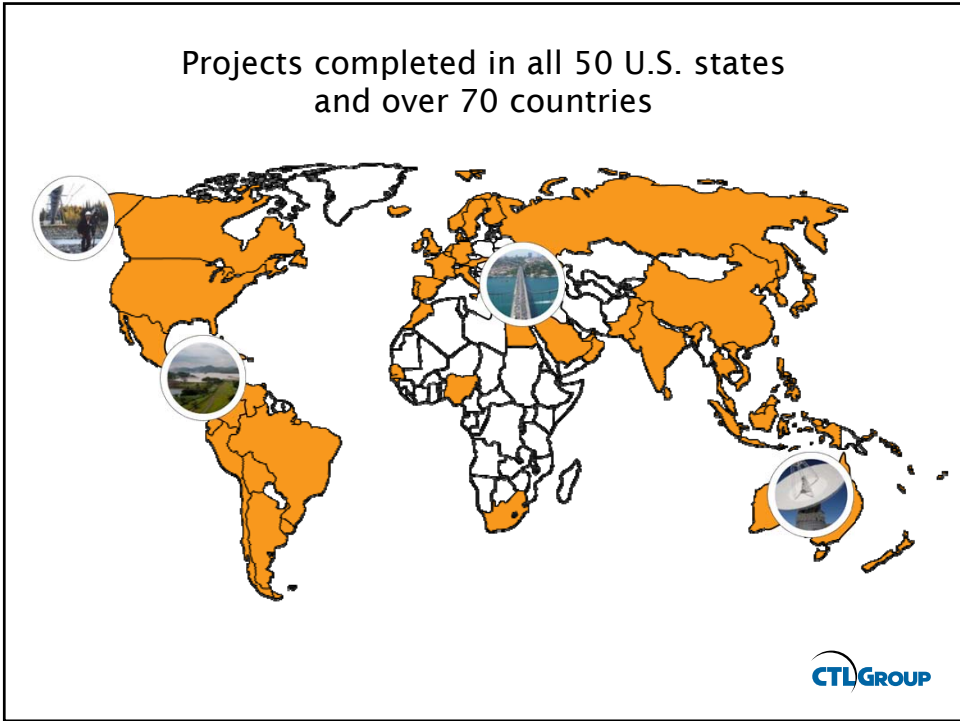
**Anthony F. Bentivegna, Ph.D., P.E.**

May 2, 2017



## A Look at CTLGroup

CTLGroup is a global leader in  
engineering and materials  
science consulting.



A team of 103 engineers, architects  
and materials scientists

15% have Ph.D.  
degrees

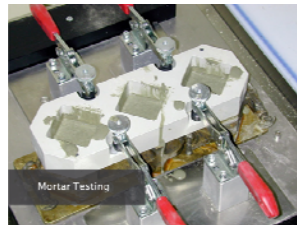
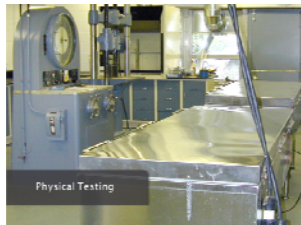


25% have given  
expert testimony



## Company Overview – Laboratory Services

► 5,500 m<sup>2</sup> of laboratory facilities




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## Quality Assurance

Audited by



ISO  
IEC



NIAC  
Nuclear Industry  
Assessment Committee

NQA-1 Compliant




ISO 9001:2008  
BUREAU VERITAS  
Certification



IAS  
ACCREDITED  
17025

QMS system meets the most demanding requirements for engineering consulting and testing of materials and structural components.




ASHTO  
1914



ASSOCIATION  
OF AMERICAN  
RAILROADS




MIAMI DADE  
COUNTY



STADIUM®



Corps of Engineers



## Personal Background

**Anthony Bentivegna, PhD, PE**  
Laboratory Manager and Materials Consultant

- ▶ Manager of Testing Laboratories in Chicago, IL, USA
- ▶ Liaison for CTLGroup-Qatar Laboratory in Doha, Qatar
- ▶ PhD, University of Texas at Austin, Civil Engineering
- ▶ Professional Engineer, Multiple States in USA

**Technical Expertise**

- ▶ Concrete and Concrete Durability Related Testing
  - Alkali-silica Reaction, Delayed Ettringite Formation, Freeze/Thaw, and Shrinkage
- ▶ Diagnosis and Repair of Structures which Suffer Premature Deterioration due to Concrete Durability Issues.
- ▶ Project Oversight for Numerous Global Projects
- ▶ Facilitate Laboratory Services and Testing to Engineering Application



## Technical Expertise: Repair of Historic Structures



## Technical Expertise: Field Investigations (Durability)



## Technical Expertise: Field Investigations (Low-Strength Investigations)



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## Technical Expertise: Laboratory Management



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## 3<sup>rd</sup> Cement Conference and Workshop in Kuwait

- ▶ Understanding ASTM International Test Procedures For Cement And Concrete - Staying Up To Standard
- ▶ Focus:
  - Slag Cements
  - Portland Cement
  - Fresh Concrete Properties
  - Hardened Concrete Properties

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## 2015 ASTM Workshop

- ▶ Introduction to ASTM Standards
- ▶ Fundamentals of Testing
  - Physical Properties of Cement
  - Concrete Fresh Properties
  - Concrete Hardened Properties
- ▶ Importance of 3<sup>rd</sup> Party Testing



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## 2016 ASTM Workshop

- ▶ Staying Up To Standard
- ▶ Review of Standard Test Methods
- ▶ Introduction to:
  - Cement Standards
  - Cement Phase Calculations
  - Mortar Test Methods
  - Durability Test Methods



ASTM  
INTERNATIONAL



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## Presentation Outline (1/3)

- ▶ Tuesday May 2, 2017:
  - Slag Cement
    - Introduction and manufacturing,
    - Characteristics, and
    - Durability
    - Specification Limits and Impacts
  - Portland Cement
    - Introduction and manufacturing,
    - Characteristics, and
    - Durability
    - Specification Limits and Impacts

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## Presentation Outline (2/3)

### ▶ Wednesday May 3, 2017:

- Fresh Concrete Testing:
  - ASTM C172 – Practice for Sampling Freshly Mixed Concrete (Review)
  - ASTM C31 – Practice for Making and Curing Concrete Test Specimens in the Field (Review)
  - ASTM C143 – Slump of Concrete (Review)
  - ASTM C138 – Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete (Review)
  - ASTM C403 - Time of Setting of Concrete
  - ASTM C232 – Bleeding of Concrete

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## Presentation Outline (3/3)

### ▶ Wednesday May 3, 2017:

- Hardened Concrete Testing:
  - ASTM C39 – Compressive Strength Testing (Review)
  - ASTM C1202 – Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration (Review)
  - ASTM C469 - Modulus of Elasticity
  - ASTM C496 - Splitting Tensile Strength
  - ASTM C157 - Drying Shrinkage

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## Learning Objectives of Test Methods

- ▶ Understand the reasons for conducting each test,
- ▶ Define terminology pertinent,
- ▶ Identify necessary equipment,
- ▶ Understand the sampling procedures,
- ▶ Understand limitations, and
- ▶ Witness demonstrations (videos).

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## Why Do We Perform Standardized Tests?

- ▶ **The ultimate goal is to.....build buildings, bridges, roadways, and all concrete structures that are safe and durable.**

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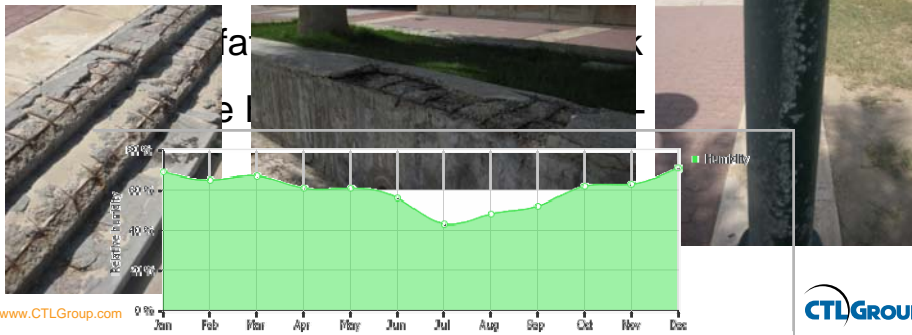


## Concrete in Kuwait



## Many Durability Concerns

- ▶ Weather – high temperatures can lead to cracking and potential for delayed ettringite formation in mass concretes.
- ▶ Salt exposure – Corrosion



## Ideally...

- ▶ We want test that are accurate and precise.
  - Accurate meaning they tell us the future of the concrete in the field, but
  - Many of our test aren't designed for that.



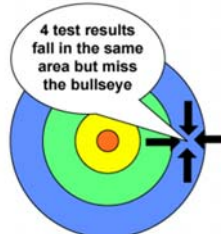
Accuracy

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## So, We Will Focus on Precision.

- ▶ We will discuss the standards in detail, from the equipment to the nuisances of the testing procedures.
- ▶ So, that you can get precise results that are repeatable in your laboratory and amongst other laboratories.



Precision

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## How Do We Prevent Mistakes?

- ▶ Quality Training
- ▶ Reading Standards and Practices
- ▶ Bad Habits are Passed Down
- ▶ Internal and External Audits
- ▶ Yearly Performance Evaluations
- ▶ Reading All Related Standards and Practices

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Questions & Answers