



AMERICAN COUNCIL FOR
CONSTRUCTION EDUCATION

Program Director's Session *Featured Presentation*

Outcomes Based Assessment A Simplified Approach

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Contents

1. **Goals** of today's presentation & Motivation
2. **Explain with examples** Outcomes Based Assessment (OBA) - A Simplified Approach
3. **Differentiate** ABET Vs SACS & initiatives by ASCE
4. **Conclusions** – OBA corresponds to *performance based specification*

Goals of presentation

Outcomes Based Assessments - OBA

- Motivation for outcomes based assessment
- Present a simplified approach of OBA
- Identify critical elements of OBA e.g. action verbs
- Share examples of assessments & use of results
 - Course
 - Program
 - University
- Our vision for future of ACCE

Motivation

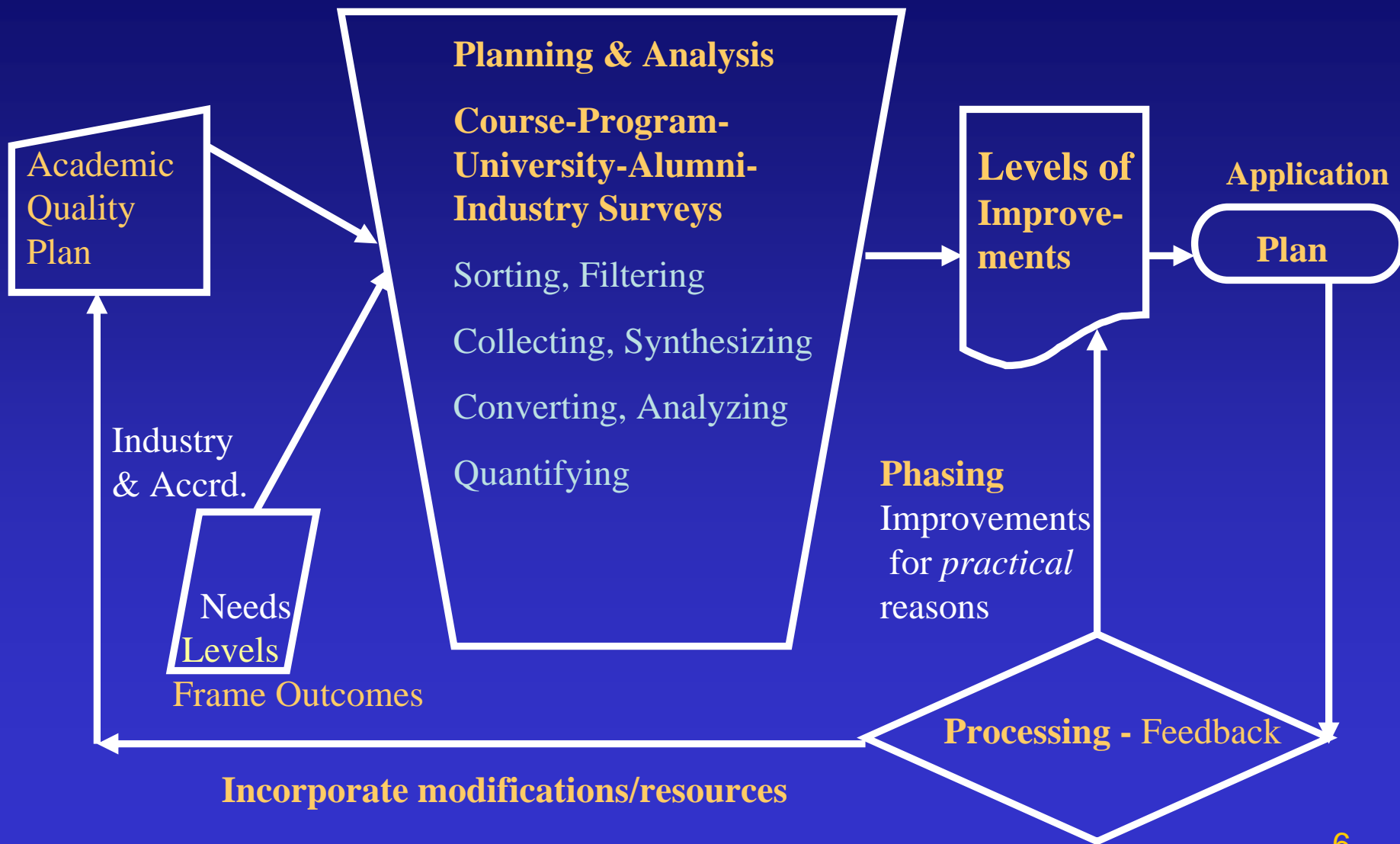
Assessment & Improvement

1. Fulfill industry needs through Improved student learning
2. Improve retention
3. Satisfy ACCE & other organization needs
4. Develop tools for assessments - levels
5. Generate documentation tracking Improvement

ACCE Requirements for Assessments

- Academic Quality Plan
 - ✓ **Purpose** - Continual assessment and improvement
 - ✓ **Basis** - Mission statement, goals and measurable outcomes
 - ✓ **Method** - Obtain and process inputs at course, program, & school level
- Planning and Analysis
 - ✓ Develop systematic means of collecting, quantifying and analyzing data
 - ✓ Compare and Critique differences between expectation and measurement
- Application
 - ✓ Review and Update Course(s), Services, &/or Program Goals and Outcome Measures
- Process
 - ✓ Record program revisions and learning outcomes
 - ✓ Repeat the cycle: (Collecting, quantifying, analyzing, formulating, modifying)

OBA – Process Model



OBA Data sources – Levels

- Course
- Program
- School
- Alumni
- Industry Employers

Data: Assessment Plan

Assessment Method	Frequency of Assessment	Data Collected Media	Frequency of Evaluation
Industry Evaluation	Twice a year	Assessments' Reports	Once per year
Exit Interviews	Once per year	Response to Interview Questions	Once per year
Employer Surveys	Once every three year	Surveys	Once every three year
Alumni Survey	Once every three year	Surveys	Once every three year
Capstone Project	Twice a year	Faculty Assessment Reports	Once per year

Example: Program Level outcomes

1. Estimate construction project implementation costs
2. Produce construction project implementation schedules
3. Analyze process materials and methods of construction - ethical, social and environmental perspectives
4. Demonstrate people skills to function as a team player
5. Demonstrate communication ability with project team
6. Carryout construction project management related tasks
7. Demonstrate capability to pursue advanced degree programs

Program outcomes relationship with courses

<u>Courses</u>	<u>1000</u>	<u>2000</u>	<u>3000</u>	<u>3110</u>	<u>3160</u>	<u>3180</u>	<u>3190</u>
1. Estimate construction project implementation costs.		X	X			X	X
2. Produce construction project implementation schedules.				X		X	
3. Analyze process materials and methods of construction from an ethical, social and environmental responsible perspective.	X	X	X	X	X	X	X

OBA Assessment Tool – Course level

Learning Outcome	Assessment Tool	Target (%)	Achieved (%)	Improvement Plan
<i>OutCome-1</i>	<i>Test or HW or Pop Quiz</i>	<i>Set by Instructor e.g. 85%</i>	<i>Students' Score 87%</i>	<i>Met Target. No Action Required</i>
<i>OutCome-2</i>	<i>Test or HW or Pop Quiz</i>	<i>Set by Instructor e.g.90%</i>	<i>Students' Score 80%</i>	<i>Not Met Target. Discuss more examples.</i>

OBA Course Level Assessment Example – CM 3210

Learning Outcome	Assessment Tool	Target Level (%)	Average Grade (%)	Course Improvement Plan
Model real world structures in two dimensions for analysis	HW-2	90	95.8	Target met. No action required
	Exam I - Question-1 & Exam I - Question-2	90	94.2	Target met. No action required
Analyze and design simple steel beams and columns for flexure, shear and deflection	HW-3	90	99.7	Target met. No action required
	HW-4	90	91.8	Target met. No action required
	Exam II	90	97.7	Target met. No action required
Analyze and design simple reinforced concrete beams and columns for flexure, shear and deflection	HW-5	90	90.6	Target met. No action required
	Exam III - Question -1	90	91.8	Target met. No action required
Analyze and design reinforced concrete slab and footing for flexure, shear and deflection	Exam III -Question -3, Question - 4	90	91.8	Target met. No action required

Note: Though most of the students performed above expectation level of 90% , but still more clarification is required in design of slab and footing. More examples will be used while explaining slab and footing. The expectation level will be set to 90% for the next semester.

Outcomes: Improvement Plan

- Please note that context of observations and **improvements** are **Outcomes** based
- Measurements could be done through either a quiz, or a homework or an exams

CM 3210 – 2007 OBA Plan/Outcome

- The target level set for this course was 90%. Most of the students performed above target expectation level. During the semester it was observed that students spent more time on understanding the design of RC foundation, and slab than expected

Improvement for next offering of the course

- The design of RC foundation and slab will be discussed by working more examples in class
- The target expectation will not be changed and be again set to 90%

CM 3210 – Course Improvement Plan 2008

- The target level set for this course was 90%. Based on the Fall 2007 results, extra time was allotted for design of RC slabs and foundations. Students scored higher than Fall 2007 for **course outcome** “Analyze and design reinforced concrete slab and footing for flexure, shear and deflection”.
- It was observed that the students got confused with the formulae given in the text book for the bending moment and shear force calculation, as notations used in formulae were not explained. Due to it, students scored less than the target for the **course outcome** “Model real world structures in two dimensions for analysis”

Improvement Actions:

- The formulae for calculation of bending moment and shear force for different cases will be prepared and given in the class
- Two classes will be allotted for discussing the design of RC foundation
- The target expectation will not be changed and be set to 90%.

Program Level Assessments

➤ Capstone Project

- A BIG PROJECT, that measures understanding of theory and practice
- We can use it to measure systematization (building on previous knowledge)
- Defended before industry-department panel

Ability to schedule a 5-7 M Project

Ability to prepare a comprehensive cost estimate

Ability to do job costing & do cash flow analysis

Ability to prepare a safety plan for a given project

Ability to analyze financial, legal and economic impacts

Ability to communicate (Oral and written) with project team

Outcomes	Target Level**	Actual Level**	Department Improvement Plan
1- Estimate construction project implementation costs.	3.50	3.67	Met Outcome level
2. Produce construction project implementation schedules.	3.50	3.71	Met Outcome level
3. Carryout construction project management related tasks.	3.50	3.00	Improve Teaching PM issues
4. Demonstrate people skills to function as a team player.	3.50	3.72	Met Outcome level
5. Demonstrate communication ability with construction project team members.	3.50	3.72	Met Outcome level
6. Demonstrate capability to pursue advanced degree programs.	3.50	3.00	Improve Teaching on writing and Spelling Checking Skills
7. Analyze process materials and methods of construction from an ethical, social and environmental responsible perspective.	3.50	3.00	Include ethical, social and environmental perspectives in teachings

** 1 = Just Enough, 5= Excellent

Program Level Assessments

Capstone outcome – Use of results

Best Features

Good Financial planning
 Good Document, Accepts Criticism
 Honest
 Excellent project, Best Development
 Good Document
 Good Presentation, Knowledge
 Good Explanation, Excellent Project
 Professional approach
 Knows Project

 Good Project Summary \$ Understanding
 Contracts, Insurance, Payoffs
 Oral Presentation, Answers Questions

Areas of Improvement

Schedule Development
 Professional work
 Financial Analysis, Grammar, Presentation
 Estimation
 Presentation Skills
 Financial Analysis, Presentation
 Schedule, Critic ability
 Cash Flow, Billings
 Presentation Skills, Scheduling, Additive
 Bond, Pay Request
 Cost Allocation, Financial Analysis
 Financial Analysis
 Estimation

University Level Assessments

- Enrollment growth through positive referral
- Job placement and internships
- Student retention and attrition causes
- Performance of auxiliary services

Student learning

Retention

Job placement

Campus life and activities (non academic)

Auxiliary services e.g. financial aid office

Outcomes of core curriculum

Learning outcomes based assessments

Other professions & accreditation agencies

- Other professions and societies e.g. ASCE have come up with course and program level outcomes
- ABET accredited educational programs require learning outcomes
- Regional accreditation bodies e.g. SACSCS support outcomes based assessments

ABET Versus SACS Program Outcomes

ABET Outcomes

Customarily, outcomes A-K have been used, & they continue to be used by many programs.

Currently, some programs embed these outcomes in one or more courses designed by the faculty of that program.

SACS Outcomes

SACS encourages each academic program to write student learning outcomes which are appropriate for that discipline

ABET Assessment Methods

Program Outcomes

ABET Outcomes

Step 1—A map of assessment methods is created; this map includes both direct and indirect measures.

Step 2—A Curricular Map is created.

Step 3—Each faculty member measures the a-k outcomes by using tests, projects, etc., and keeps records by course.

Step 4—At the end of the semester, the faculty member fills out a form indicating whether each program outcome was or was not met in that course.

Step 5—At the year's end, faculty question each other about whether and how the outcomes were met in each course (peer review).

Step 6—Indirect methods such as student surveys, exit interviews, and employer surveys are administered, collected, and analyzed

SACS Assessment Methods Program Outcomes

1. SACS recommends that a blend of direct and indirect methods be used (“best practices”)
2. Direct methods include the use of course-embedded assessment and standardized tests
3. Indirect methods include the use of surveys, interviews, and focus groups

Other initiatives

- American Society of Civil Engineers is currently finalizing
 - Outcomes based rubric – *Body of Knowledge* BOK
 - Clear specification of *Levels of Achievement*
 - Where each level of achievement will be received e.g. BS courses, MS courses, or through experience

	ASCE Body of Knowledge Ruberic (BOK)					
Level of Achievement	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
	1	2	3	4	5	6
Learning Outcomes						
Foundation						
Mathematics	Light Blue	Light Blue	Light Blue			
Natural sciences	Light Blue	Light Blue	Light Blue			
Humanities	Light Blue	Light Blue	Light Blue			
Social Sciences	Light Blue	Light Blue	Light Blue			
Technical						
Material science	Light Blue	Light Blue	Light Blue			
Mechanics	Light Blue	Light Blue	Light Blue	Light Blue		
Experiments	Light Blue	Light Blue	Light Blue	Light Blue	Yellow	
Problem recog. & Solving	Light Blue	Light Blue	Light Blue	Yellow		
Design	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Orange
Sustainability	Light Blue	Light Blue	Light Blue	Orange		
Contemp. Issues & hist. Persp.	Light Blue	Light Blue	Light Blue	Orange		
Risk & Uncertainty	Light Blue	Light Blue	Light Blue	Orange		
Project Management	Light Blue	Light Blue	Light Blue	Orange		
Breadth in CE areas	Light Blue	Light Blue	Light Blue	Light Blue		
Technical Specialization	Light Blue	Yellow	Yellow	Yellow	Yellow	Orange
Professional						
Communication	Light Blue	Light Blue	Light Blue	Light Blue	Orange	
Public Policy	Light Blue	Light Blue	Orange			
Business & Public Admin.	Light Blue	Light Blue	Orange			
Globalization	Light Blue	Light Blue	Light Blue	Orange		
Leadership	Light Blue	Light Blue	Light Blue	Orange		
Teamwork	Light Blue	Light Blue	Light Blue	Orange		
Attitudes	Light Blue	Light Blue	Orange			
Lifelong Learning	Light Blue	Light Blue	Light Blue	Orange	Orange	
Professional & Ethical responsib.	Light Blue	Light Blue	Light Blue	Light Blue	Orange	Orange
Key	Light Blue		Yellow		Orange	25
	Bachelor Degree		Masters Degree		Experience	

Vision for Future - ACCE Body of Knowledge Rubric (BOK)

Level of Achievement	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
Mathematics Core & Gen. Ed						
Natural sciences						
Humanities						
Social Sciences						
Lifelong Learning						
Professional & Ethical response.						
Material science Construction						
Construction Sciences						
Estimating						
Scheduling						
Sustainability						
Building Information Modeling						
Managing Risk & Uncertainty						
Project Management						
Capstone						
Technical Concentration						
Communication Business						
Public Policy						
Business & Management.						
Globalization						
Leadership						
Teamwork						
Attitudes						
Bachelor Degree		Post Baccalaureate		Internships		

ACCE Current Status

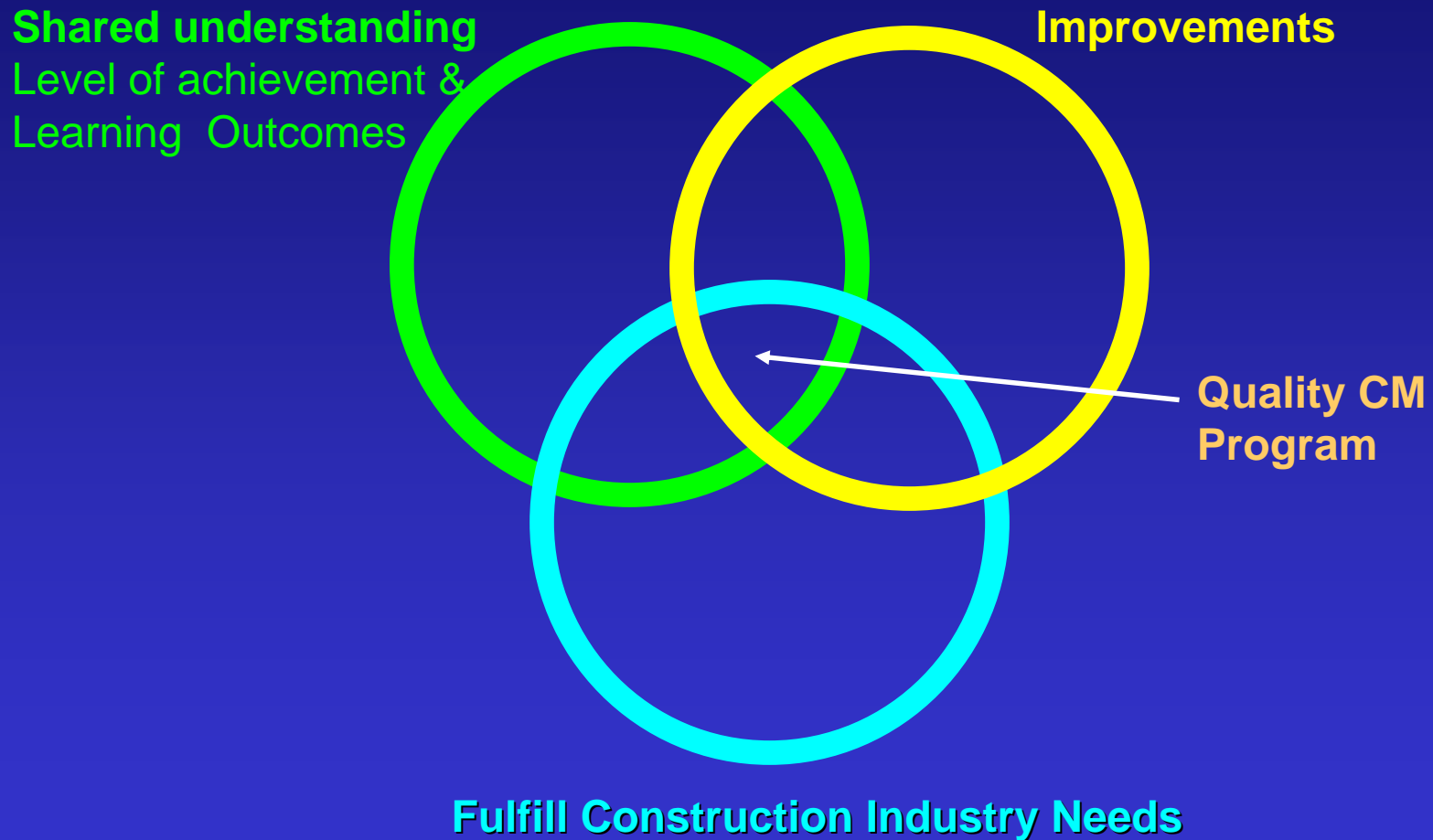
- ACCE has defined Curriculum Matrix
- What are likely to be the next steps for us?

-
- ❁ Outcomes based rubric for ACCE?
 - ❁ Define levels of achievement for ACCE?
 - ❁ Where each level of achievement will be received in ACCE?
 - BS, Post Bac., experience (internships)

Levels of Outcomes Assessment

- **University** (eg. Core Learning, Enrollment Growth/Stability, Employment Success, Etc.)
- **School** (eg. Program Stability/Growth)
- **Department** (eg. Retention, Student Achievement)
- **Course** (eg. Knowledge Integration, Skills Development)

Quality CM Program - Growing the sweet spot



Conclusions

- A **simplified** approach to quality improvement based on learning outcomes **is possible**
- Identifying **outcomes** at each level (course, program, and university) **are essential**
- **Outcomes need to be measurable**
(through quiz, homework, exams, etc.)

“Outcomes Based Assessment & Improvement”
correspond to **“Performance Based Spec. in Design-Build Projects”**

Levels of Achievement

Bloom's Taxonomy of Educational Objectives

1. Knowledge
2. Comprehension
3. Application
4. Analysis
5. Synthesis
6. Evaluation

References

Stating Objectives for Classroom Instruction 2nd Edition
Webster's Third New International Dictionary, Unabridged
Levels of Achievement Subcommittee Report, ASCE

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