DEVELOPING A CARBON-NEUTRAL FUTURE

the role of organizations
2.75 billion additional by 2060
By 2060:

- Global building floor area increase
- 230 billion m$^2$ or 2.3 trillion ft$^2$
- This **doubles** current worldwide building stock
- "building an entirely new planet next to the existing one" …in forty years
  – Ed Mazria, Executive Director of Architecture 2030
Paris Climate Agreement
A global carbon budget of 340 GtCO₂ gives a 67% probability of meeting the 1.5°C warming target.
Global Temperature Projections for various RCP Scenarios

- RCP8.5: Business-as-usual
  - Emissions peak 2080
- RCP6.0: Emissions peak 2080
- RCP4.5: Emissions peak 2040-50
- RCP2.6: Zero CO₂ emissions ~2040

Source: Architecture 2030; Adapted from IPCC Fifth Assessment Report, 2013

Representative Concentration Pathways (RCPs): Scenarios for future emissions and the RCPs.
A CARBON NEUTRAL, BUILT ENVIRONMENT

Step 1
- Planning, Design & Construction

70% – 80% of goal

Step 2
- Renewables

20% – 30% of goal
THE PCA ROAD MAP

The value chain

CLINKER
Key chemically reactive ingredient

CEMENT
The binder

CONCRETE
Critically useful material to society

CONSTRUCTION
Service life / use phase impacts

CARBONATION
Concrete is a CO₂ sink

https://www.cement.org/sustainability/roadmap-to-carbon-neutrality
THE PCA ROAD MAP: SOLUTIONS

NEAR-TERM

- Replace raw materials with recycled materials
- Produce low-carbon cement blends
- Optimize designs for the lowest life cycle emissions

MID-TERM

- Increase the use of alternative fuels
- Use renewable energy

LONG-TERM

- Carbon capture
- Introduce new cement blends

https://www.cement.org/sustainability/roadmap-to-carbon-neutrality
The concrete industry produces about **10 billion tons** annually.
BARRIERS TO SUCCESS?
Why organizations have to take active roles...
SHRINKING WORKFORCE
DEFIANCE
MARKET SUSTAINABILITY

1. Tech Enthusiasts
2. Visionaries
3. Early Adopters
4. Early Majority
5. Pragmatists
6. Conservatives
7. Skeptics

Innovators
Early Adopters
Early Majority
Late Majority
Laggards
Renewal, Reinvention and Responsibility
HOW DO WE:

LEARN | INSPIRE | LEAD

TO ENSURE SUCCESS?
HOW DO WE DEFINE SUCCESS?
RENEWAL: EVOLVING FROM THE OUTSIDE
REINVENTION: CREATING VISION

As published in Architect magazine
REINVENTION: LIBERATING CREATIVITY
MARS PAVILION

Joseph Sarafian – Parametric Architecture
Architect magazine
CONFLUENCE PARK — SAN ANTONIO
Concrete is the second most consumed material in the world, the water is first.

RESPONSIBILITY: EVOLVING THE BUILT ENVIRONMENT
RESPONSIBILITY:
RECYCLING AND RECOVERY
### Table 5.3.2—Concrete design requirements for exposure categories and classes

<table>
<thead>
<tr>
<th>Exposure class</th>
<th>Maximum w/cm</th>
<th>Minimum $f'_c$, psi</th>
<th>Additional minimum requirements</th>
<th>Limits on cementsitious materials</th>
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<tbody>
<tr>
<td>RF0</td>
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<td>2500</td>
<td>N/A</td>
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<tr>
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#### Cementitious materials

<table>
<thead>
<tr>
<th>Type</th>
<th>Contents</th>
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</thead>
<tbody>
<tr>
<td>ASTM C150/C150M</td>
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</tr>
<tr>
<td>ASTM C595/C595M</td>
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<tr>
<td>ASTM C1157/C1157M</td>
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</table>

#### Calcium chloride admixture

<table>
<thead>
<tr>
<th>Exposure class</th>
<th>Maximum slump</th>
<th>Minimum $f'_c$, psi</th>
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<tbody>
<tr>
<td>RF0</td>
<td>6</td>
<td>2500</td>
</tr>
<tr>
<td>RF1</td>
<td>5</td>
<td>3000</td>
</tr>
<tr>
<td>RF2</td>
<td>5</td>
<td>3500</td>
</tr>
<tr>
<td>RF3</td>
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<td>4000</td>
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</table>

### Table 5.3.2—Exposure categories and classes

<table>
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<th>Exposure class</th>
<th>Maximum slump</th>
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<tr>
<td>RC2</td>
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<td>4000</td>
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</tbody>
</table>

*Maximum specified slump shall have a tolerance for purposes of field testing.

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**Maximum water-soluble chloride ion (CT) content in concrete, percent by mass of cementitious materials in reinforced concrete**

<table>
<thead>
<tr>
<th>Type</th>
<th>CT content</th>
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<tr>
<td>RC0</td>
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<td>RC1</td>
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<tr>
<td>RC2</td>
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**Commentary**

- Permitted for members assigned with Exposure Classes RS2 and RS3 because of the potential for inducing the chloride resistance of concrete. Its use may also be restricted for members with structural reinforcement assigned to Exposure Category RC. The limits for are stated in terms of chloride ion. When there is no other source of chlorides in the concrete ingredients, the limit on calcium chloride is approximately double the chloride ion limit in 1 percent.
DEVELOPING A CARBON-NEUTRAL FUTURE

the role of organizations

COMMITMENT

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