Indiana Limestone Vs. the Elements
A Case Study in Limestone Paver Durability
INTRODUCTION

Architects seek the best products for their application to turn their designs into reality. Picking a material that is eye-catching, durable, and cost-effective is critical. Also, environmental impact in this day and age is seen as increasingly important. Urban Hardscapes by Indiana Limestone Company represent the next generation of the already-rich history surrounding limestone quarried in the “Crossroads of America.”

In the following case study, we will discuss the most common uses for limestone pavers, common misconceptions and realities about limestone pavers, and how limestone compares to the competition in the landscaping marketplace.
COMMON USES FOR LIMESTONE PAVERS

Indiana Limestone pavers are used for patios, decks, stepping stones, pool surrounds, and more. They are distinctive, with natural variations, and offer a light, welcoming appearance. Featuring eleven standard sizes in 1-1/2" and 2" thicknesses, Indiana Limestone pavers are available in Full Color Blend and can be used in a variety of patterns.

Modesto paver pattern.
Mix of different standard size pavers.

24" x 24" Standard size pavers.
MISCONCEPTION VS. REALITY

In this section, we’ll explore some of the common misconceptions and realities surrounding the use of limestone as a paver.

Misconception #1: Limestone installation is problematic

**Reality:** Indiana Limestone is actually quite easy to install, if the correct procedures are followed. Being an absorptive stone, limestone will wick moisture from any source in close proximity. When that source is construction site wash, concrete slab substrate, or the setting mortar, improper installation could result in an alkaline stain in the stone. Indiana Limestone provides comprehensive Installation and Technical Guides on their [website](http://www.indianalimestone.com).

Misconception #2: Limestone should not be used in cold weather climates

**Reality:** While the Indiana Limestone Institute (ILI) does not recognize any accelerated weathering tests, they instead defer to centuries of empirical data based off the product being on 35 out of 50 state capitols, including in Alaska and North Dakota, as well as iconic landmarks like the Empire State Building and the National Cathedral. All of the aforementioned examples are enduring quite well over the years in extreme climates. Bismarck, North Dakota, has an average high temperature of around 25 degrees for at least three months of the year. The state capitol building, originally built in 1934, has a facade clad in Indiana Limestone (North Dakota Government Website). The building has been renovated, but the limestone used on the original project remains in top condition.
**Misconception #3:*** Limestone is not durable

**Reality:** Throughout history, limestone has been used in iconic structures such as the Acropolis at Athens, the Parthenon, Pyramids of Egypt, Chichén Itzá structures in the Yucatán, and the Colosseum of Rome. The Pentagon was constructed with Indiana Limestone and was reconstructed after the 9/11 terrorist attacks with the same limestone. Limestone is also used, for example, in The Empire State Building, Holocaust Memorial Museum, Lincoln Memorial, and the Biltmore Estate.

Indiana Limestone wall and pier caps are a recommended alternative to cast masonry to avoid cracking or crazing in freeze & thaw environments. The Indiana Limestone Institute references their empirical data on various large-scale projects that date back decades and have needed very minor maintenance as proof of the stone’s natural durability.

### LIMESTONE STRENGTH

| Material                                      | Strength Minimum (PSI)
|-----------------------------------------------|------------------------
| Limestone Class II (Medium Density - Indiana Limestone) | 700                    |
| Modulus of Rupture¹                           | 700                    |
| Compressive Strength³                         | 4000                   |

**NOTES:**

¹ **Flexural strength**, also known as modulus of rupture, bend strength, or fracture strength, a mechanical parameter for brittle material, is defined as a material’s ability to resist deformation under load.

² **PSI: Pounds per Square Inch:** For example a human's ground pressure (psi) would be about 8 psi, while a mountain bike’s ground pressure would be approximately 40 psi, and a passenger car about 30 psi.

³ **Compressive Strength:** The resistance of a material to breaking under compression

Being a natural product, Indiana Limestone’s physical properties, such as strength values, will vary. The physical properties depend upon texture, moisture content, etc.

Test results are based on many samples and tests by the industry, Geological Survey, and Bureau of Standards.

Indiana Limestone is classified as a Type II Dimension Limestone under ASTM C-568 and meets or exceeds the strength requirements found in this classification.

Data from: ([Link](#) - Indiana Limestone Institute)

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultimate Compressive Strength</td>
<td>4,000 psi minimum</td>
</tr>
<tr>
<td>Dry Specimens</td>
<td></td>
</tr>
<tr>
<td>Modulus of Rupture</td>
<td>700 psi minimum</td>
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<tr>
<td>Absorption of Water</td>
<td>7 ½ percent maximum</td>
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<tr>
<td>Abrasion Resistance</td>
<td>6-17 (ASTM C241)</td>
</tr>
<tr>
<td>(Link - ASTM)</td>
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</table>
**Misconception #4:** Limestone must be sealed

**Reality:** “In general, while a valid argument can often be made for sealing interior stone, given that the self-cleaning effects of the weather won’t come into play, the ILI believes it’s better to leave exterior stone uncoated to weather naturally.”

- Todd Schnatzmeyer, Indiana Limestone Institute Executive Director

The ILI’s research shows a sealer is not needed for Indiana Limestone because the chemical compound will inhibit the natural ability of the stone to fend off moisture and expel other impurities that could be absorbed as the seasons shift.

Waterproof coatings should rarely, if ever, be used on stone. Although these coatings prevent water infiltration, they have a tendency to trap moisture within the stone and the masonry in general. Even water-repellent sealers will prevent the natural migration of water from stone and should be used with great caution, if at all.

At the same time, the Indiana Limestone Institute recommends dampproofing be applied to all unexposed faces of the stone, including where the stone connects to other materials or before it is placed in the ground (where limestone is to be used at or below grade, dampproofing must be applied). Dampproofing differs from sealing in that it is a cementitious coating applied to the back and sides of the stone creating a barrier and thereby preventing moisture from alkali-charged sources absorbing into the stone.
LIMESTONE PAVERS VS THE COMPETITION

Indiana Limestone pavers offer a very specific landscaping aesthetic that cannot be duplicated by concrete or asphalt. Unlike concrete, brick, or asphalt, limestone is not created through a mixture of natural stone and man-made aggregates, or petroleum byproducts. The limited environmental impact of quarrying, cutting, and dressing operations for Indiana Limestone makes it an exceptional green product.
**Environmental Data: Limestone Vs. Granite**

<table>
<thead>
<tr>
<th>ENVIRONMENTAL DATA - LIMESTONE</th>
<th>QUARRYING</th>
<th>PROCESSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embodied Energy (Btu/ton)</td>
<td>1.4 million</td>
<td>4.7 million</td>
</tr>
<tr>
<td>Embodied Water (gal/ton)</td>
<td>600</td>
<td>19,000</td>
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<tr>
<td>Global Warming Potential</td>
<td>20</td>
<td>80</td>
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<tr>
<td>(kg CO2 equivalents/ft³ stone)</td>
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<td></td>
</tr>
<tr>
<td>Volatile Organic Compounds (VOC)</td>
<td>None directly emitted from limestone</td>
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</table>

<table>
<thead>
<tr>
<th>ENVIRONMENTAL DATA - GRANITE</th>
<th>QUARRYING</th>
<th>PROCESSING</th>
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</thead>
<tbody>
<tr>
<td>Embodied Energy (Btu/ton)</td>
<td>4.6 million</td>
<td>17 million</td>
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<tr>
<td>Embodied Water (gal/ton)</td>
<td>310</td>
<td>9500</td>
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<tr>
<td>Global Warming Potential</td>
<td>100</td>
<td>500</td>
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<tr>
<td>(kg CO2 equivalents/ft³ stone)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volatile Organic Compounds (VOC)</td>
<td>None directly emitted from granite</td>
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</tbody>
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While no environmental data exists for marble’s environmental impact, the Natural Stone Council’s comparison of granite to limestone outlines a higher global warming potential for granite.

**Materials Fact Sheet Limestone**

Indiana Limestone is extracted efficiently with minimal waste of stone or energy. It doesn’t require the multiple manufacturing processes and energy expenditures necessary to produce man-made products such as cast stone. For projects in the central Midwest, it may earn LEED credits for certain projects. In comparison, a material such as brick or concrete must be “assembled” in energy-intensive processes.
CONCLUSION

Indiana Limestone pavers offer the ultimate in durability and beauty for landscaping and hardscaping projects. The new Urban Hardscapes line continues in Indiana Limestone Company’s rich tradition of providing a long-lasting material that can withstand most weather conditions.

The misconceptions about Indiana Limestone exist, but are not the reality of how the material truly functions. The realities can be seen after installation--buildings and projects using Indiana Limestone are still standing, no matter the weather forecast, with very little wear.

When compared to similar materials, Indiana Limestone beats the competition!

Reference List
1. Indiana Limestone
2. Indiana Limestone Company
3. Why Use Indiana Limestone?
4. Stone and Sustainability
5. Limestone Quarrying and Processing
6. How to Specify Indiana Limestone
7. The Use and Overuse of Testing in Specifying Dimensional Limestone
8. Indiana Limestone Company Technical Guides
9. Structures and Monuments in Which Indiana Stone was Used
10. Famous Buildings Made of Limestone
11. Limestone vs Cast Stone
12. Cleaning Indiana Limestone
13. Installation and Technical Information
14. Landscape Paving 101: How to Use Limestone for Your Patio