Issues with Visitation in Historic Buildings and How to Solve Them

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What We Do

We are a structural engineering firm that focuses exclusively on historic structures.

It is our job to evaluate and analyze historic buildings, and develop sensitive structural design solutions.
Visitation

- Introduction
- Visitors vs Buildings
  - Museums vs House Museums
- Common Problems
  - Fall Prevention
  - Fire Protection
  - Egress
  - Accessibility
- Structural
  - Overloading
  - Handrails
  - Stairs
  - Vibration
- Code Issues
  - Change of Occupancy
- Case Studies
Case Studies

- Floor Loading
  - Drayton Hall (Great Room, Stair Hall)
  - SC Society Hall (Trimmer Joists)
  - St. James – Goose Creek (Balcony)
  - Telfair Academy (Floor Oculus)
  - Porches – a collection

- Stair Loading
  - Drayton Hall (again!)
  - SC Society Hall
  - Bodie Island Lighthouse
  - Hunting Island Lighthouse

- Handrails
  - Drayton Hall (again!!)
  - Fort Jefferson
  - Fort Pulaski
  - Fort Sumter
A Quick Poll

1. You are closely connected with, work for, or run a house museum or historic structure open to the public.

2. You are concerned about the number of visitors coming through.
• Bennett’s Theorem
  – If you can keep the water out, you will solve your building’s problems.

• The Corollary
  – If you keep the people out, you will solve your building’s visitorship problems.
Visitors vs Buildings

Visitation issues are not limited to residential structures now open to the public.

Forts, churches, lighthouses and other unique buildings also have their share of challenges from visitorship that differs from their original purpose.

They were ALL designed for a specific use at the time of construction.
<table>
<thead>
<tr>
<th>Visible Visitation Impacts</th>
<th>Invisible Visitation Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Touching objects</td>
<td>- People standing in a tight group</td>
</tr>
<tr>
<td>- Leaning on walls</td>
<td>- Overall group sizes</td>
</tr>
<tr>
<td>- Touching historic fabric/finishes</td>
<td>- Total quantity of visitors</td>
</tr>
<tr>
<td>- Shakey handrail</td>
<td>- Fatigue of cyclical loading</td>
</tr>
<tr>
<td>- Picking at brick mortar</td>
<td></td>
</tr>
<tr>
<td>- Floor nails working loose</td>
<td></td>
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International *Existing* Building Code - IEBC

There are multiple routes through the various triggers in IEBC to get to the requirements for compliance.

Chapter 12 for Historic Buildings

1205.1 General

*Historic buildings* shall comply with the applicable structural provisions for the work as classified in Chapter 4 or 5.

*Exceptions:*
1. The code official shall be authorized to accept existing floor and existing live loads and to approve operational controls that limit the live load on any floor.
Floor Loading – Drayton Hall
Floor Loading – St. James Goose Creek
Porches

Porches and balconies were not assembly spaces. A 2010 code change now ties the load to the adjacent space, to account for actual loading.

Frequently not designed for large loads.

Purlins tend to be too small.
Girders tend to be deeply notched.
Connections tend to lack capacity.
Stair Loading – SC Society Hall
Stair Loading – Bodie Island Lighthouse
Stair Loading – Bodie Island Lighthouse
Stair Loading – Bodie Island Lighthouse
Stair Loading – Bodie Island Lighthouse
3/8 inch diameter carriage bolts, A307 HDG and coated, space at approx. 5 inches o.c. to match existing pattern. Arrange bolts to meet holes in tread grate, typ.

New L 1-1/2 x 1-1/2 x 3/16 A36 steel, HDG and coated.

Tread support angle plan

Install new tread support angle and bolts at all remaining original cast iron stair treads where supplemental support has not previously been installed.

Scale (A)
Handrails – Drayton Hall

2. CONNECTION 2 SECTION
   Scale: 3'-0" = 1'-0"

3. CONNECTION 2 DETAIL
   Scale: 3'-0" = 1'-0"

Approx. 20 deg. 

#6 x 1 1/2 inch bronze screw.

Bronze (not brass) plate 3/4 x 3/16 x 8 inch.

Match angle of screw with countersink.
Handrails – Fort Sumter
Have We Scared You Yet?

Visitorship does impact the structure.

Historic buildings have unique challenges, but there is room in the code for unique solutions.

Common principles:
• Reduce the load.
• Reduce the span.
• Limit the number of people.
• Limit the number of people at a given time.
Questions?