West Haven Public Schools  
Unit Planning Organizer

Subject: STEM ___________________________  Grade _______ 7/8 _______

Unit: Engineering Design-Bridges  Pacing: November (SM2-March)

Essential Question(s):

How can you design and build a bridge over Fudge River that meets the expectations and requirements for the residents of Candyland?

What factors determine which bridge is the best for a given area?

How do Civil Engineers consider the design and function of structures in bridge planning?

Big Idea(s):

In the design of structures there is a need to consider factors such as function, materials, safety, cost, and appearance.

Understanding the importance of balanced forces (compression/tension) and the stability of a structure.
Next Generation Science Standards (NGSS) (includes West Haven’s “Priority” NGSS in BOLD and “Supporting” Standards)

ETS1.A: Defining and Delimiting Engineering Problems
ETS1.B: Developing Possible Solutions
ETS1.C: Optimizing the Design Solution

*MS ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solution.

*MS ETS1-2 Evaluate competing design solution using a systematic process to determine how well they meet the criteria and constraints of the problem

*MS ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

*MS ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

CT – 8.4 – In the design of structures there is a need to consider In the design of structures there is a need to consider factors such as function, materials, safety, cost, and appearance.
Science and Engineering Practices (Practices in BOLD should be focused on in this unit)

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

“Unwrapped” Concepts and Skills, and Bloom Levels (BL)

<table>
<thead>
<tr>
<th>Concepts (Need to Know)</th>
<th>Skills (Able to Do)</th>
<th>Crosscutting concepts</th>
<th>BL</th>
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<tbody>
<tr>
<td>Forces</td>
<td>Determine (similarities &amp; differences)</td>
<td>Influence of science, engineering, and technology on society and the natural world.</td>
<td>1. Knowledge</td>
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<tr>
<td>Structures</td>
<td>Identify (best characteristics)</td>
<td>*MS-ETS1-1</td>
<td>2. Comprehension</td>
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<td></td>
<td>Develop (possible solutions)</td>
<td>CC7: Stability and Change</td>
<td>4. Analysis</td>
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<td>Test</td>
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<td>5. Synthesis</td>
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<td>Evaluate</td>
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<td>6. Evaluation</td>
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<td>Revise (if needed)</td>
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<td></td>
<td>Calculate</td>
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<td>Measure</td>
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Assessments

PBL: Students are challenged as civil engineers to make a bid for a bridge to meet the expectations of given scenario and criteria. Students will construct and present model.

CA: Bridges

“Dipsticks” (Informal Progress Monitoring Checks):

Forces Lab
Shapes Lab
Bridge Research
West Point Bridge Design (computer simulated)

Instructional Planning

Suggested Resources/Materials/PBL:

PBL materials: jellybeans, marshmallows, toothpicks, straws, string, bucket, sand, weights, balance, spaghetti, glue

PBS Building Big Bridges web (www.pbs.org)

Student Bridge Notebook

Lego Kits

Powerpoint presentations
Suggested Research-based Effective Instructional Strategies:

- Set objectives & Provide feedback
- Use Models to investigate
- Generate & test hypothesis
- Collect & organize data
- Cooperative learning groups
- Nonlinguistic representation
- Problem solving and decision-making
- Productive talk
- Scaffolding
- Team Diagraming
<table>
<thead>
<tr>
<th>Vocabulary/Word Wall</th>
<th>Enrichment/Extension</th>
<th>Interdisciplinary Connections Math/LA</th>
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<tbody>
<tr>
<td>Beam Bridge</td>
<td>Apply budget constraints</td>
<td>CCSS.ELA-Literacy.</td>
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<tr>
<td>Arch Bridge</td>
<td>Creating a bid for presentation</td>
<td>CCRA.SL.5: Make strategic use of digital</td>
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<tr>
<td>Suspension Bridge</td>
<td>Build to scale</td>
<td>media and visual displays of data to</td>
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<td>Truss</td>
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<td>express information</td>
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<td>Structure</td>
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<td>Written research on bridge types</td>
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<td>Balanced Force</td>
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<td>Analyzing bridge disasters</td>
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<tr>
<td>Unbalanced Force</td>
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<td>CCSS.Math.Practice.MP4: Model with Mathematics</td>
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<td>Compression</td>
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<td>CCSS.Math.Practice.MP5: Use appropriate tools</td>
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<td>Tension</td>
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<td>strategically.</td>
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- Investigation/analysis task

Unit ____________ Bridges_________________