

**MDE GRANT MODELS OF DEMONSTRATED PROFICIENCY GRANT
FINAL REPORT
Project Overview Part 1: Define**

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Name of Project

Building Bridges

Report Date:
June 22, 2010

Subject/Course:

Geometry

Grade Level: 10

Other subject areas to be included, if any:

Physics

Grade Level: 10 -
12

Project Idea

Summary of the issue, challenge, investigation, scenario, or problem:

Proving that triangles are congruent using SSS, SAS, AAS, ASA, and HL. Use theorems about congruent triangles to design a safe, sturdy bridge.

Driving Questions

What makes a bridge strong? How do you design a sturdy bridge?

Content and Skills Standards to be addressed:

G2.3.1 Prove that triangles are congruent using the SSS, SAS, ASA, and AAS criteria and that right triangles are congruent using the hypotenuse-leg criterion.

G2.3.2 Use theorems about congruent triangles to prove additional theorems and solve problems, with and without use of coordinates.

??? G2.3.3 Prove that triangles are similar by using SSS, SAS, and AA conditions for similarity.

R? G1.1.3 Perform and justify constructions, including midpoint of a line segment and bisector of an angle, using straightedge and compass.

G1.2.2 Construct and justify arguments and solve multi-step problems involving angle measure, side length, perimeter, and area of all types of triangles.

G1.2.3 Know a proof of the Pythagorean Theorem, and use the Pythagorean Theorem and its converse to solve multi-step problems.

G1.2.4 Prove and use the relationships among the side lengths and the angles of 30°- 60°- 90° triangles and 45°- 45°- 90° triangles.

R? G1.2.5 Solve multi-step problems and construct proofs about the properties of medians, altitudes and perpendicular bisectors to the sides of a triangle, and the angle

bisectors of a triangle. Using a straightedge and compass, construct these lines.

G 1.8.2 Identify symmetries of pyramids, prisms, cones, cylinders, hemispheres, and spheres.

G2.2.1 Identify or sketch a possible three-dimensional figure, given two-dimensional views. Create a two-dimensional representation of a three-dimensional figure.

P3.1d Identify the basic forces in everyday interactions.

P3.2C Calculate the net force acting on an object.

P3.3A Identify the action and reaction force

P3.4B Identify forces acting on objects moving with constant velocity (e.g., cars on a highway).

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21st Century Skills

to be explicitly taught and assessed (T+A) or that will be encouraged (E) by projectwork, but not taught or assessed:

...

T+A E

T+A E

Collaboration x Communication x

Presentation x Technology x

Critical Thinking x x

Group: Bridge

Presentation
Audience:
Class

Class:
Honors
Geometry
and
Geometry

School:
Hamtramck
High

Experts:
Person(s)
with
physics/
math
background

Web:
Student
initiative

Other:

Part 2: Design

"**Grabber**" to launch inquiry & generate interest: How do bridges support very heavy weights and not collapse?

Assessments:

**Formative
Assessments:
(Checkpoints
during
Project)**

Draw sketch of
bridge

Strength tests of
triangles,
quadrilaterals,
and
quadrilaterals
with diagonal
braces

Strength tests of
3-dimensional
pyramids, cubes,
and cubes with
diagonal braces

Quizzes –
Congruent
Triangles
And
Quadrilaterals

Other:

**Summative
Assessments:
(End of
Project)**

Written
Product(s), with
rubric: Group
notes and
observations
about strength
tests and the
actual bridge
performance
under stress
(weight pulling
down from the
top of the
bridges or
textbooks or
weights placed
on top of the
bridges.

Other
Product(s) or
Performance(s),
with rubric:
Strength test of
the bridge
using weights
pulling down
from the top or
weights placed
on top of the
bridge

	<p>Essay: Individual essay describing what makes a strong sturdy bridge using geometric principles and physics principles</p>	<p>Peer Evaluation</p>
		<p>Self-Evaluation</p>
		<p>Other:</p>
<p>Debriefing Methods</p>	<p>(Individual, Group, and/or Whole Class)</p>	
...		<p>Other:</p>
<p>Resources Needed Textbook: <u>Geometry Tools for a Changing World</u> Prentice Hall 1998? Cardboard for preliminary strength tests of shapes Craft sticks Super Glue Scissors Gloves Goggles Pail for weight test Weights String or rope for weight test Scale to weigh bridges before testing</p>		<p>On-site people, facilities: Used science lab and classroom for bridge tests.</p> <p>Equipment: Goggles Pail for weight test Weights String or rope for weight test Scale to weigh bridges before testing</p> <p>Materials: Cardboard Craft sticks Super Glue Scissors Gloves</p>

Project Teaching and Learning Guide

Project:

Course/Semester:

**Knowledge and Skills
Needed by Students**

to successfully complete
culminating products
and performances, and
do well on summative
assessments

Scaffolding/Materials/Lessons to be Provided

by the project teacher, other teachers, experts, mentors, community members--

Describe the active teaching needed to support learning

Bridge Building	-	Bridge experts talks to class at beginning and returns periodically to add information
	>	and answer student questions. If possible, bridge expert judges and helps with strength tests.
The Prentice Hall Geometry Tools for a Changing World Chapter 8 Project was the source idea for this project.		
Congruency of Triangles	-	Chapter 8
	>	
Properties of Quadrilaterals		Chapter 9
Similarity of triangles and polygons		Chapter 10
Properties of right triangles		Chapter 11
	-	Bridge Building from Toothpicks
	>	http://www.worsleyschool.net/science/files/bridge/building.html
		Bridge Structure What makes a structure strong or weak?
		http://www.worsleyschool.net/science/files/bridge/bridge1.html
		I-Beams
		http://www.worsleyschool.net/science/files/bridge/ibeam/page.html
		Bridge Photos
		http://www.worsleyschool.net/science/files/bridge/bridgephotos.html
		Using Toothpicks
		http://www.worsleyschool.net/science/files/bridge/bridge2.html
		Marshmallow Bridges
		http://www.worsleyschool.net/science/files/bridge/bridges.html
		The Plan
		http://www.worsleyschool.net/science/files/bridge/bridge3.html
		Rules
		http://www.worsleyschool.net/science/files/bridge/rules.html
		Build a Virtual Bridge

<http://www.worsleyschool.net/science/files/bridge/virtual/virtualbridge.html>

- Bridge Activity
 - > <http://mathforum.org/alejandre/frisbie/bridge.html>

- Bridge Competition Images
 - > <http://www.bnl.gov/education/contests/bridge/images/2006BridgePics/aesthetic.JPG>
<http://www.bnl.gov/education/contests/bridge/images/2007Bridge/2007BridgeContest-e.jpg>

- Toothpick Bridge Building
 - > <http://homepage2.nifty.com/SUBAL/BCTOPE.htm>
|Materials and Procedure
<http://homepage2.nifty.com/SUBAL/BCmakingE.htm>
Cutting
<http://homepage2.nifty.com/SUBAL/BCmaking1E.htm>
Making Straight Sticks
<http://homepage2.nifty.com/SUBAL/BCmaking2E.htm>
Force and Shape/Arch
<http://homepage2.nifty.com/SUBAL/ArchE.htm>
Force and Shape/Truss
<http://homepage2.nifty.com/SUBAL/BCmaking4E.htm>
Winners
<http://homepage2.nifty.com/SUBAL/BCPrE.htm>
Carrie's Toothpick Bridge Project
<http://homepage2.nifty.com/SUBAL/carrie/CarrieProE.htm>

- <http://www.galaxy.net/~k12/structure/index.shtml>
 - >

- <http://www.balsabridge.com/>
 - >

- <http://www.yale.edu/ynhti/curriculum/units/2001/5/01.05.09.x.html>
 - > <http://www.matsuo-bridge.co.jp/english/bridges/index.shtml>
<http://www.pbs.org/wgbh/nova/bridge/>
<http://www.pbs.org/wgbh/buildingbig/bridge/index.html>
<http://www.eng.brad.ac.uk/>
<http://www.howstuffworks.com/bridge.htm>
<http://www.endex.com/qf/buildings/bbridge/bbridge.html>
http://www.learningwave.com/lwonline/geometry_section1/lessons/triangles1.html
<http://education.sdsc.edu/download/enrich/bridges.pdf>
<http://region6.mainelearns.org/bridges.html>

- <http://www.bridgesite.com/funand.htm>
 - > <http://www.matsuo-bridge.co.jp/english/bridges/index.shtml>

Project Calendar (Project should be 1 or more weeks)

Project Start Date: Week of April 26, 2010

Project End Date: June 15, 2010

Week(s)	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
One		Introduce project		Team building activities	Team building
Two			Expert speaker	Planning/ Strength tests -2 – dimensional with strong cardboard	
Three	Teambuilding	Plan for 3-d strength tests	Group results of strength test #1(2-d)	Introduce guidelines and rubric for bridges (limit of 35 craft sticks and bridge must be at least 10 inches long)	Build for strength test #2(3-d with craft sticks)
Four	Finish test 2			Group reports of test 2	Video of Donald in Mathemagic Land
Five	Start bridges	Draw sketches as time permits for this week and next two weeks.	Bridge expert stops by as available in weeks five, six and seven		
Six					
Seven			Strength tests of bridges	Strength tests of bridges with one	Strength test of low compact bridges

EVALUATION

other class with books
on top of
the bridges.

Eight

Group Notes and
Observations

Individual
essay

Total number of students participating in project	Approximately 62students (3 Geometry classes)
Number of students with special needs	At least one.
Results (Outcomes supported by Data)	Students built bridges that used triangles and most were able to explain What makes a strong bridge. Most included triangles and many talked Compactness and symmetry.
Describe how students with special needs benefited from the project.	They were able to participate in designing and building the bridge and The critical thinking aspect.
What did you learn from your experience with Project Based Learning?	I learned that the students really enjoyed being able to plan, design, and Build a bridge. I also learned more about building bridges and designing A future bridge or other project.
What student or teacher challenges were faced in the implementation of the projects (i.e. peer issues, technology issues, time problems, etc.)?	Some group issues where certain students did not want to work together, But most were able to resolve their issues. Some student lack of Involvement in groups or absences. We ran out of time because the Project was started so late in the year. Some kids missed part of the End tests because of end of the year issues.
Additional Comments	I hope to implement this project again. The other teachers also liked it. I have a better idea of how to grade the group part, but still plan to work On that part. This time the bridges were 75% of the group grade and the Notes and observation were 25% of the group grade. I gave it a value of One test grade. The individual essay was a half test grade. Next year I

	Would like to bring in community members to judge the bridges. This Year the bridge expert was available to help with tests and judging. One Teacher used toothpicks and did not limit the number of toothpicks.
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