Math & Construction: Curriculum, Community, & Career Connections

**www.tinyurl.com/Math-Construction**

Created and Presented By:

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0. Creative Construction Introduction - [https://inhub.thehenryford.org/overview/why-innovation-learning](https://inhub.thehenryford.org/overview/why-innovation-learning)

1. Connect to the community & utilize community resources
   - **a. Learn from community resources & expose students to opportunities**
     - Promote first-hand experiences
       2. Special Events/Opportunities
         - Contact your CTE System Director - [https://www.isbe.net/Documents/efe_directory.pdf](https://www.isbe.net/Documents/efe_directory.pdf)
         - SIBA Career Expo – Sept/Oct- Contact Donna Richter @ dmr@siba-agc.org
         - Manufacturing Day –Sept- Contact Mark Bosworth @ Mark.Bosworth@swic.edu
     - FREE Camps and/or Internships
       - Ex - St. Louis / Metro East – Ts [https://ranken.edu/summer-stem-academies/](https://ranken.edu/summer-stem-academies/)
       - Ex – E. St. Louis - Ss [www.r3dev.org](https://www.r3dev.org) & [www.lansdowneup.org](https://www.lansdowneup.org)
       - Ex – St. Louis – Ss ([https://building-futures.org/programs/](https://building-futures.org/programs/))
   - **b. Engage students in projects/problems/activities involving their community, potential careers, & pathways**
     - Projects
       - Provide letters, videos, etc. from the community asking students for help with a project
       - Consider utilizing the engineering design process & allow students to take on career focused roles
     - Problems/Activities
       - Incorporate other subjects, career connections, real-world terminology, & hands-on work
       - Create powerpoints, drawings, computer generated models, 3D scale models
         - Students share their work with the community - [http://web.nationalbuildingarts.org/programs/education/](http://web.nationalbuildingarts.org/programs/education/)
       - Calculate costs w/ real data (Quote sheet found as an additional doc @ [http://www.tinyurl.com/Math-Construction](http://www.tinyurl.com/Math-Construction))

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A. Architect or Drafting Technician
✓ Activity - Reflect an existing floorplan
✓ Activity – Create a floorplan & elevation for a house to be built in a new development.
    o By hand using grid paper – Grid paper available @ https://incompetech.com
✓ Activity – Use an architect (or drafting/architecture student) created design plan (See provided copy) and build a 3d model.
✓ Activity – Explore Google Sketchup found at http://edu.sketchup.com/ to replicate the classroom or a room (works best with a mouse)
✓ *Explore Activity #1 - *Building with Blocks – Orthographic Drawings & Perspective
✓ Community College Resource: https://www.swic.edu/academics/career-degrees/computer-aided-design/
✓ Resource - http://www.k5architecture.org/Download_chpt.htm

B. Builder or Developer
✓ Review property lines & measurements using a known address or parcel number via the county’s mapping and platting office at https://www.co.st-clair.il.us/departments/mapping-platting
✓ How to use Mapping & Platting County GIS software video @ https://youtu.be/a7GKVI5iFMI
✓ Understand zoning requirements and easement restrictions when considering development of lots
✓ Problem: A piece of property, parcel number 02170105020, was acquired by the Lansdowne LLC. What is the address? Will the given Habitat for Humanity house fit on the lot?
✓ Explore Activity #2A - https://www.co.st-clair.il.us/departments/mapping-platting
    ✓ Will the Habitat for Humanity house fit the lot in East St. Louis if the required setback on the side is 10 feet, while the front and back require around 20 feet at a minimum?
✓ Explore Activity #2B - https://www.co.st-clair.il.us/departments/mapping-platting
    ✓ Explore another address or another county’s mapping and platting website

C. Surveyor
✓ Land Boundary Survey
✓ Activity - “Stake out a lot” and/or position a house on a lot
✓ Problems:
    o Identify the corners of a house as “waypoints”.
    o If the house design is reflected over the y-axis, determine the points of its reflection.
✓ Explore Activity #3 - Conduct an Impervious Land Survey
    ✓ Resources:
      ▪ https://digitalcommons.imsa.edu/pfs_tr/24/
✓ Tree Surveys
    ▪ https://extension.psu.edu/a-guide-to-preserving-trees-in-development-projects
    ▪ https://www.deltalandsurveying.net/tree.htm
    Locate/map trees 8 inches in diameter which “allows the design of drainage, retention areas and utilities serving the project … to determine which trees may need to be removed…”

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C. Surveyor (continued)

✓ Research
  o Kory Allred from Parkland College explained that he measured heights of trees to help a researcher
to determine whether drones were able to accurately measure tree height.
    ▪ Problem - Find the height of a tree (NOTE: I recommend that teachers invite a surveyor to their
school, talk w/ students about training/skills needed, show his/her Total Station/Drone, and then
provide an accurate measurement to check student results.)
  3 Methods:
    a. Find the height of a person and use estimation and addition
    b. Use a clinometer (angle of elevation) & trig (or isosceles triangles)
      ✓ Classroom Clinometer - https://www.geopacks.com/products/clinometer

✓ Cell Tower Surveys - https://tinyurl.com/yckh5uas
✓ Explore Activity #4 - Outside

✓ Community College Resources/Opportunities
  ✓ Parkland Community College (Champaign, IL) – Instructor Kory Allred - kallred@parkland.edu
  ✓ SWIC – ENGR 251 – Class held on Saturdays in Fall https://www.swic.edu/academics/transfer-degrees/engineering/curriculum/

D. Operating Engineer

• Union Resource: https://www.oe520.org/
• Use machinery & math skills to move construction materials & excavate (move) dirt around a
construction site using equipment such as bull dozers, excavators, cranes, etc.
  ✓ Bulldozers first…deal with moving dirt, leveling land, or making land at a certain gradient
    ▪ Slope = rise over run
      o https://extension.tennessee.edu/MasterGardener/CommunicationArchive/Measuring%20Your%20Slope-%20Ludwig.pdf
    ▪ Grade = Slope as percentage
      o Activity: Find the slope and grade of land using a line level & check using a “Clinometer”
        Smartphone App (Free Android) - https://freeappsforme.com/inclinometer-apps/
        ✓ Materials needed string, stakes, measuring tape, & bubble level (https://a.co/d/3Emla5g)
      ▪ Explore Activity #5 – Install & explore the Clinometer + Bubble Level App
      ▪ Dozers have tools/tech that show operators what slope the machine is sitting on
        o Slope meter = https://www.amazon.com/Slope-Meter-Inc-No-2/dp/B00UCl9CWW
        o Slope Indicate & Slope Target Technology
          ▪ Mainfall slope, cross slope, & blade slope (https://youtu.be/IalSEo7zLTI?t=541)
            • Positive Slope (Dozer going up hill) vs Negative Slope (Dozer going downhill)
      ▪ Equipment uses GPS (global positioning system involving satellites) to determine location
        ✓ GPS identifies latitude, longitude, & elevation (https://education.nationalgeographic.org/resource/gps)
        o Equipment will show current elevation & design elevation (https://youtu.be/7hQ825QgcM4)
        o GPS can be used for programming grading & dig locations

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D. Operating Engineer (continued)

✓ Excavators remove dirt
  - Video: https://youtu.be/EckOzAhUe5I

Problem: A basement for a house needs to be dug out 36 ft long, 30 ft wide, and 12 ft deep.
1. How much material does the heavy equipment operator need to excavate?
2. If the cost of basement excavation is $15 per cubic yard, what is the cost of excavation? (Quote from Hanks Excavating 7.26.22)
3. The excavation company is required to pay the crew for a full day regardless of how long the excavation takes place, so the overall cost is still an additional $4000 per day since the crew is there the full day. How much is the total cost of the excavation project, including labor, which can be completed in one day with no backfilling or special grading? (Quote from Hanks Excavating 7.26.22)

- Suggestion: Insert career notes into warm-ups, lessons, and student activity sheets.
- Problem: Equipment often have tracks due to Traction, Stability, & Surface Protection
- Review the traction coefficient chart at https://tinyurl.com/5n92ybu3. Are tracks or wheels better on hard surfaces? Are tracks or wheels in loose materials such as dirt?

• Explore Activity #6 – Compare the ground pressure of a Dozer compared to a person.
  A) A Caterpillar D3K LGP Dozer with two tracks has a weight of 17,842 pounds. Its two tracks are each 25 inches wide and 7 feet in length. (https://www.ritchiespecs.com/model/caterpillar-d3-crawler-tractor). Find the ground pressure (pounds per square inch) exerted by the dozer.
  B) Find the ground pressure (PSI) exerted by an unknown person standing on two feet.
  C) How does the ground pressure of the person compare to the ground pressure exerted by a Caterpillar D3K LGP Dozer? (Reference: https://youtu.be/4dbrDPEUmEY

E. Construction Project Manager

- Construction managers oversee all aspects of the building process
  - 4-year College Resource - https://www.siue.edu/academics/undergraduate/degrees-and-programs/construction-management/
- Drones are being used to monitor/communicate progress w/ clients, improve safety, & estimate inventory (Resource: https://uavcoach.com/drones-in-construction/)
  - Drones use GPS (global positioning system involving satellites) which can identify specific points by latitude, longitude, & elevation based on intersecting circles and distance = rate x time.
    ▪ Activity 2: Fly/land a Quadro Copter to various assigned “ground control” or “wayward points”
      Ex – Snaptain 350 Mini Drone ($12.99)
    ▪ Activity 3: Use a drone image in Desmos to identify points, etc.
      Ex - https://www.desmos.com/calculator/e0za6r74gj
    ▪ Activity 4: Use a drone captured image in GeoGebra & find the area of the construction site.
      Ex - https://www.geogebra.org/geometry/rhkvvdft
  - Explore Activity #8 – Find an image & insert into Desmos.
F. Carpenter

- **Carpenters’ Training Center** - [www.carpenters.org/training_centers/il/](http://www.carpenters.org/training_centers/il/)
- **Picture Frames**
  - Partner with a CTE Teacher to have CTE students teach math students how to build a picture frame
  - Coincide this activity with “border problems” w/ area or solving a quadratic equation
  - Coincide this activity with a “letter to a teacher” activity done in English classes
- **Walls are made up of studs and plates** ([https://youtu.be/Wlg8LOHmbtw](https://youtu.be/Wlg8LOHmbtw))
  - Studs are vertical
    - Standard size is 2x4 (actual size is 1 ½ inches x 3 ½ inches of various lengths)
    - Typically, placed 16 inches apart along the length of a wall
    - More studs are used at doors, corners, and windows for extra strength
    - Vertical framing must be “plumb”
      - Plumbness cab be determined w/ a bubble level, laser level, or plum bob ([https://youtu.be/ZuRtD9ZOSSE](https://youtu.be/ZuRtD9ZOSSE))
    - Explore Activity #9: Using [https://www.tinkercad.com/](https://www.tinkercad.com/), create a model 2 x 4 stud that is 0.33 in by 0.17 in, by 8 in and/or create a house model in millimeters
  - Plates are horizontal
    - Plates are basically studs on their back… Plates at the bottom and top of a wall
    - Horizontal framing must be “level”
      - Levelness can be determined w/ a bubble level, laser level, or plum bob
    - **Problem:** Estimate the # of studs & cost for studs to frame a room w/ given blueprints
      - Note: The number of studs can be estimated to equal the number of linear feet (one foot measurement along a line). (Reference: A Blueprint for Geometry. Retrieved from [https://archive.org/details/blueprintforgeom0000fult](https://archive.org/details/blueprintforgeom0000fult))
      - Cost per stud is $4.48 (quote from Lowes 6.26.22)
    - **Activity:** Look at boxes of nails/screws of different sizes & explore hammering different sizes nails and drilling different sized screws
    - **Activity:** Build a wall with studs & plates laying down and then stand into place
    - **Problem:** Walls & corners must be “square”. Using only a tape measure, how can be determine that the wall is square and corners are square?
      - Ans1 @ [https://youtu.be/NGXvnt6vFZw](https://youtu.be/NGXvnt6vFZw) & Ans2 @ [https://bit.ly/3Rc3G0h](https://bit.ly/3Rc3G0h) & Speed Square
  - **Problem:** Find the truss angles [https://www.mathgiraffe.com/blog/geometry-with-roof-trusses](https://www.mathgiraffe.com/blog/geometry-with-roof-trusses)
  - **Wheelchair ramps** – The American with Disabilities Act (ADA) requires wheelchair ramps to have a maximum slope ratio of 1:12 (known also as 1″:12” or 1″:1’)
    - **Problem:** Determine if the following slopes meet the ADA for wheelchair ramps:
      - 3/12, 1/13, 1/10
    - **Problem:** An elderly neighbor is need of a wheelchair ramp. Determine the dimensions of a piece of plywood that can be used to build the ramp. (Example: [https://youtu.be/tWLPKOMIaRs?t=20](https://youtu.be/tWLPKOMIaRs))
    - **Engineering Extension:** [https://www.teachengineering.org/activities/view/wpi_empathy_activity3](https://www.teachengineering.org/activities/view/wpi_empathy_activity3)

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G. Roofing Contractor

- Estimators use a tape measure & trundle wheel to take measurements for replacing an existing roof.
- Estimators use architectural rulers to take measurements from blueprints for new construction.

**Notes:**
- Shingles & felt create a protective barrier on a roof so that water does not leak into a building.
- 10% should be added to the roof’s area for shingles as well as felt.
- A bundle of architectural shingles costs $32 (quote from Home Depot, 6.26.22)
- A Square of architectural shingles costs $90 (research 6.26.22)
- A roll of felt covers 2 Squares and costs $22 (quote from Home Depot, 6.26.22)
- Labor to install a roof is approximately $2.25 per square foot (research 6.26.22)

- Installers must be harnessed to a line anchored to the ridge of the roof.
- Slope & pitch of a roof are DIFFERENT
  - Slope = vertical rise compared to run
  - Pitch = vertical rise compared to entire span

- Union Apprenticeship Training: [https://unionroofers.com/where-we-are/#/?filter=State-%3AIL](https://unionroofers.com/where-we-are/#/?filter=State-%3AIL)
- Connect w/ a Science teacher - Climate Change & Challenges for Construction - [https://bit.ly/3RJo74m](https://bit.ly/3RJo74m)
- **Problems:**
  1. Identify the type of roof (gable vs hip), take measures, determine the area to be roofed with felt & shingles, and calculate the cost for materials and installation using the given blueprints.
  2. Review the house found at [https://www.desmos.com/calculator/pt4im8eyrt](https://www.desmos.com/calculator/pt4im8eyrt)
     i. Find the slope of the roof. Write the corresponding equation of the rafter,
     ii. Find the pitch of the roof.
- **Explore Activity #10** – Go to [https://www.desmos.com/calculator/pt4im8eyrt](https://www.desmos.com/calculator/pt4im8eyrt) and model the rafter of the house with a linear equation.

H. Bricklayer

- **Problem:** If the front façade of a house is to contain brick, determine the area to be covered in brick, & the # of bricks needed. (Note: Mortar thickness is 3/8 inch (same as diameter of a piece of chalk.).
- Contact the Bricklayers about visiting the classroom to do a brick laying activity
  - Similar to the activity conducted at Career Expo: [https://youtu.be/L4abROfXFlk?t=44](https://youtu.be/L4abROfXFlk?t=44)
  - Union Resource: [https://bac8il.com/contact-us](https://bac8il.com/contact-us)
I. Pipelayers, Pipefitters, Plumbers, & Engineers
     - **Problems:**
       - Sketch a graph of water usage during the day
       - Water towers are tall to provide pressure. Each foot of height provides 0.43 PSI (pounds per square Inch) of pressure.
         - Write a function
       - The new water tower near Kitty Hawk NC is approximately 165 feet tall with a spheroid nearly 47 feet in diameter.
         - Determine the amount of pressure.
         - Determine how many gallons of water it can hold.
     - **Extension/Connection to swimming** - deeper the water the more pressure (linear relationship) - [https://www.vernier.com/experiment/rwv-3_pool-plunge-linear-relationship-between-water-depth-and-pressure](https://www.vernier.com/experiment/rwv-3_pool-plunge-linear-relationship-between-water-depth-and-pressure)
   - **Examples/Other Resources:**
     - [https://activerain.com/blogsview/2304478/tanks-for-the-memories](https://activerain.com/blogsview/2304478/tanks-for-the-memories)
     - [https://www.pttg.com/elevated-water-storage-tanks/](https://www.pttg.com/elevated-water-storage-tanks/)
   - **Topics:** Measuring, Fractions, Special Right Triangles, Circumference, Volume of a Cylinder
     - [https://files.eric.ed.gov/fulltext/ED263434.pdf](https://files.eric.ed.gov/fulltext/ED263434.pdf) (Ex – Find the length of a curved pipe)
   - **Resources**
     - [https://youtu.be/1nLrTn260OD4](https://youtu.be/1nLrTn260OD4)
     - [https://riverbendmath.org/modules/Plumbing/info](https://riverbendmath.org/modules/Plumbing/info)
     - Drain waste pipes - [https://youtu.be/QDOwsG_V9H8](https://youtu.be/QDOwsG_V9H8)
   - **Determine pipe size and/or cut paper towel rolls of certain length**
   - Connect with a science teacher - Water Cycle or Water Drought or Water Pollution

J. Glazing Contractor
   - **Design - Transformation of Windows** – What do you notice? What do you wonder?
   - **Determine energy efficiency**
     - Note: “The amount of glass on the exterior walls of a (building) affects its energy efficiency. Windows are a major source of heat loss in the winter and a large source of heat gain in the summer. A rule of thumb is that the area of the windows should be approximately 10% of the area of the (building) to provide a balance between natural lighting and excessive energy consumption” (Fulton & Lombard, 1997, p.40, retrieved from [https://archive.org/details/blueprintforgeom0000fult](https://archive.org/details/blueprintforgeom0000fult))
     - **Problem:** Find the total area of the windows and divide by the square footage of house to determine the % of glass for energy efficiency.
   - **NOTE:** Windows in the future will be replaced by transparent solar panels! ([https://bit.ly/3B3xkiv](https://bit.ly/3B3xkiv))

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K. Flooring Contractor

- **Problem:** Determine flooring type and area to be covered within a new house. Then, determine the cost without installation. (Note: 6% must be added on for waste.)
- **Activity:** Put materials within a 3D house model to represent your flooring choices.

L. Electrician or Electrical Engineer

- **Union Resource:** [https://www.ibew309.com/](https://www.ibew309.com/)
- **Activity:** Read Blueprints to Determine # of Lights/Switches/Outlets Needed in Building a House
- **Problem:** Calculate Area & Determine Lumens Needed for a Room
- **Activity:** Use a multimeter under supervision to test if an outlet is wired correctly
  - **Explore Activity #11:** [https://phet.colorado.edu/en/simulations/circuit-construction-kit-ac/activities](https://phet.colorado.edu/en/simulations/circuit-construction-kit-ac/activities)
- **Problem:** Determine the area covered by solar panels that could be installed on a south facing rooftop. Then, use [https://sunroof.withgoogle.com/](https://sunroof.withgoogle.com/) to determine solar savings and/or the potential of the community.
  - Note: Residential solar panels are about 5.4 feet by 3.25 feet.
  - Note: Solar panels can reduce electricity usage and positively impact the environment. Most solar panels in the United States face south since maximum sunlight comes from the South all year long.
- **Activity:** Build a circuit (Reference: [https://youtu.be/KgnX-CZE_44](https://youtu.be/KgnX-CZE_44))
- **Activity:** Create a circuit to light up a light (create a front porch light for a house model).
- Solve equations involving Ohms Law - [https://www.electronics-tutorials.ws/dccircuits/dcp_2.html](https://www.electronics-tutorials.ws/dccircuits/dcp_2.html)
- Work on cell towers, light posts, in addition to wiring homes, etc.
- Measure and Bend Conduit
  - [https://files.eric.ed.gov/fulltext/ED263428.pdf](https://files.eric.ed.gov/fulltext/ED263428.pdf)

M. HVAC Technician or Mechanical Engineer

- **Problem:** Determine the cubic ft of space within the classroom to be heated & cooled
- **Activity:** Determine the HVAC load and the size of the HVAC unit for a house using given blueprints.
  - Formula Resource: [https://indeedhi.re/3mp1Kn6](https://indeedhi.re/3mp1Kn6) (What does BTU stand for?)
  - Example of HVAC Curriculum - [https://www.swic.edu/academics/career-degrees/hvacr/curriculum/](https://www.swic.edu/academics/career-degrees/hvacr/curriculum/)
  - Community College Resource: SWIC – Keith Otten, HVAC Coordinator - keith.otten@swic.edu
- Other associated skills/fields:
  - Sheetmetal
    - [https://files.eric.ed.gov/fulltext/ED263428.pdf](https://files.eric.ed.gov/fulltext/ED263428.pdf)
    - [https://www.mynextmove.org/profile/summary/47-2211.00](https://www.mynextmove.org/profile/summary/47-2211.00)
  - Welding
    - [https://files.eric.ed.gov/fulltext/ED263438.pdf](https://files.eric.ed.gov/fulltext/ED263438.pdf)
  - **Explore Activity #12** – Build an open box
    - Level/topic variability –nets, measurements, give volume, quadratic equations, calculus
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N. Painter
- Depending on the project, people may purchase paint and attempt a painting project themselves or hire a professional painter - Union Info: https://www.dc58iupat.net/index.html
  - Technology has been developed by Sherwin Williams to match paint to precise digital images
    - Color Snap Visualizer App for an I-Phone or Android provides RGB color values for paint
    - Digitally represents the color as a combination of Red, Green, & Blue
  - Problem: Given that there are three different colors to start from and each has 256 possible values, how many different colors can be produced?
  - Activity: What color is created with the given RGB color values? https://www.w3schools.com/colors/colors_rgb.asp
    - (0,0,0) vs (255,255,255) vs (0,0,255)
    - https://www.w3schools.com/colors/tryit.asp?filename=trycolors_rgb
    - (255,140,0) vs (100,149,237) v (?, ?, ?)
- Types of Paints
  - Latex vs oil based
  - Latex paint can be recycled but oil-based paint must be disposed at a Hazardous Collection Event: www.co.madison.il.us/departments/planning_and_development/recycle_events.php
  - Lead Paint, VOC paint, Low VOC, & Zero VOC paint
  - Lead paint is banned
    - Homes built before 1978 will most likely have lead paint
  - Lead paint chips ingested, or lead paint dust inhaled, is hazardous which can cause asthma, brain damage, or intellectual delays.
  - Lead paint should be removed or contained by someone who is EPA trained/certified
  - VOC, or “Volatile organic compounds” are chemicals found in paint that can be detrimental to the environment & human health. (https://www.buildwithrise.com/stories/low-and-zero-voc-paint-guide )
  - Satin vs Flat paint
  - Satin good for high moisture or high traffic areas- https://painttopics.com/satin-vs-flat-paint/
- Example of a project other than a house-- https://youtu.be/_Z9xRwhLx2I?t=453
- Problem: One quart of interior paint, certified as Greenguard Gold containing low VOC, covers 100 square feet & costs $21. One gallon of the same paint covers 400 square feet & costs $44. If two coats are recommended, determine what should be bought and how much it will cost to paint all of the interior walls of the soon to be built house in the Lansdowne Development.

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O. Landscape Contractor

- Deal with hardscapes (patios, sidewalks, fencing, decks, etc.) & softscapes (grass, trees, plants, etc.)
- **Activity:** Make a concrete light post model (using a toilet paper roll) and determine how many cubic inches of concrete are needed to make the model using the concept of volume of a cylinder.  
- **Explore Activity #14** – Create/ a site plan and calculate cost of sod as well as fencing (installation not included.)
  - A pallet of sod costs $584 and covers 500 sq feet. (Quote from Home Depot 4.2.22)
  - Fencing costs, on average, $25 per linear foot w/out installation https://www.lawnstarter.com/blog/cost/fence-price/  
    - NOTE: Some cities may have cities ordinances on what is allowed.  
      EX - https://www.ofallon.org/sites/g/files/vyhlif1031/f/file/file/fence_final_is2_2.pdf

P. Cement Mason

- Cement is an ingredient of concrete
- Concrete is used to create curbs, sidewalks, patios, foundations, footings for decks, light posts, etc.
- Union Resource: https://www.opcmia.org/us-locals/
- Concrete can be made in bulk using ratios involving 3 sand, 2 aggregate, & 1 cement
- **Activity:** Create a scale model of a patio using cardstock, paper clips, & Plater of Paris
  - Reference: IMSA Future Highway Curriculum – Build It Strong Project -
    https://twitter.com/teachers4steam/status/1561770700804968450/photo/1
- **Activity:** Review https://www.desmos.com/calculator/rbu79kpjg0 , then write the equation for the hyperbola forming the St. Louis Science Center in which cement masons played a significant role in its construction.
- **Problem:** For large concrete projects, it recommended that professional cement masons be utilized. However, for a small project as a patio, sidewalk, or driveway, a DIY project is possible.
  1. Determine the size of a back patio & calculate how many cubic feet of concrete would be needed to add a back patio to a new house in the Lansdowne Up development.
     - Note: A patio, driveway or sidewalk is usually 4 inches thick.
  2. Determine how many bags of Quickrete Concrete mix will need to be purchased for the project.
  3. Estimate the cost (without tax) to purchase the bags of concrete mix.
     - Note: A 50-pound bag of Quikcrete costs $5.78 (Quoted from Lowes on 7.1.22) & will yield 0.375 cubic feet of concrete (https://content.syndigo.com/asset/8a370d9a-ca8c-4c35-8fa4-be972ce72d41/original.pdf)
Math & Construction: Curriculum, Community, & Career Connections
www.tinyurl.com/Math-Construction

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Q. Ironworkers, Civil Engineers, & Structural Engineers
   - “Sky Cowboys” (Ironworkers) create the skeleton of a building
   - Roads, office buildings, schools, sports stadiums, shopping malls, Skyscrapers, St. Louis Arch, etc.
   - Explore Activity #15: Building Yummies
   - I-Beams
     - Parallel, Perpendicular, and “skew lines” in geometry
     - Parallel planes cut by an intersecting plane in geometry
     - Problem: Analyze a graph to compare different types of beams to determine which type is the strongest - https://youtu.be/-aU-ayrNqHQ
       - Connect with a science teacher - Engineering Design Activity - https://bit.ly/3QhCbkA
       - Connect with tech – Tinkercad – Create 3D models of the different types of beams
         - General - https://www.tinkercad.com/
         - I-Beam Tutorial - https://youtu.be/3D982PYZwq0
       - Explore Activity IF TIME – Watch and create an I-Beam with Tinkercad
       - Connect to CALCULUS – https://youtu.be/MvBqCeZllpQ

R. Laborers
   - A focus on roads & bridges with diverse opportunities
     - Video - https://youtu.be/4C_Ux0UK5Sw
   - Architecture Resource:
     - Building structures - Acting out structures (Lesson 5) - http://www.k5architecture.org/pdf/g0-%20-%20Kindergarten.pdf
     - Bridge Test - http://www.dot.state.mn.us/stem/curriculum/bridgeup/forces1/index.html
     - Problem: Analyze a Parabola w/ the Golden Gate Bridge - https://digitalcommons.imsa.edu/pfs_tr/21/
     - Online PD/Curriculum regarding Future Highways – offered by IMSA – contact kvillarreal@imsa.edu

2. Partner with an organization and/or utilize community connections/resources
   a. Habitat for Humanity - https://lchabitat.org/
   c. R3 Development - https://www.r3dev.org/
   e. Lansdowne UP - https://www.lansdowneup.org/
   f. Ideas for Community Connections/Resources
      i. Your own school (Ex. OTHS building a tiny house, food truck or play house.)
      ii. Park Director (New picnic structures or benches for the park?)
      iii. City Planner, developer, architect, etc. (Other ideas?)

Recommended Citation:
https://digitalcommons.imsa.edu/pfs_pr/59
3. Promote ways students can help meet the needs of the community or organizations through fundraising or volunteer service.
   a. Have students paint over graffiti (Lansdowne Up & Nelson Mandela School)
   b. Have students design and fundraise for energy-efficient houses & encourage them to volunteer (Habitat for Humanity)
   c. Have students determine costs/raise funds to build new dog pens & encourage them to help (Boy Scouts & Granite City APA)
   d. Have students determine costs & team up w/ CTE students to build dog houses (R3/Gateway Pet Guardians)
   e. Have students determine area/dimensions & team up with CTE students to build a picture frame to put a special thank you “quote” for a special teacher (CTE Teacher & English Teacher)
   f. Inform students of what is happening in the community
      o New Dog Park, New Fire Station, New Subdivision, Potential New Library, OTHS Tiny House, etc.
   g. Talk to people in the community and/or ask students to make observations/share what is needed or what is happening in the community
      i. New Development in East St. Louis (Lansdowne Up)
      ii. Container Homes Community in East St. Louis (Lansdowne Up)
      iii. Raised bed gardens (Lansdowne Up, JJK Foundation, & the JJK FAN Center)
      iv. Picnic tables or Benches (Lansdowne Up, JJK FAN Center, https://building-futures.org/)
      v. Beds (Sleep in Heavenly Peace)
      vii. Wheelchair Ramps (Lansdowne Up, SWIC Programs & Services for Older Persons-PSOP, Churches)
      Resource: Ramp It Up - https://www.edutopia.org/stw-replicating-pbl-resources