TUESDAY Lesson Plan: Bridges & Inspection

SUBJECT	TEACHER	GRADE	DATE
Bridges and Inspection			2/23/2021

OVERVIEW

Introduce students to bridges and inspecting large projects Focuses on I-75 projects and Fort St Bascule Bridge. Will include inspection virtual field trips and bridge design program.

Please send all collated student questions to Michigan Department of Transportation - Home | Facebook as a message

PHASES	TEACHER GUIDE	STUDENT GUIDE
OBJECTIVES	• Show what bridge building looks like. • Show what the engineering solution is to getting vehicles over a river.	• Pay Attention to Videos • Ask Questions about what inspectors look for. • Ask about any questions about building bridges.
INFORMATION	• **Video 1**: "Engineering Adventures: Fort St Bascule Bridge" • **Video 2**: "Engineering Adventures: Bridge Inspection" • **Video 3**: : Fort Street Bridge Construction • **Video 4**: : Fort Street Bridge Operation	• Pause videos for questions • Pay attention to how large each bridge piece and how many people are working • Make note of what the inspectors are looking for • Make note of how long it takes for the bridge to raise.
VERIFICATION	• Please ask students to pay attention to what parts of the bridge the inspector is checking and why they are important.	• Be able to answer what part of the bridge the inspector is inspecting and why.
ACTIVITY	• Virtual field Trip with videos provided • Have your students build a bridge out of household items in their kitchen. The bridge that can hold the most weight wins.	• Try to build a model bridge with kitchen items. (Pasta, marshmallows, straws, forks, etc) • Engage in discussion of what materials built the

PHASES	TEACHER GUIDE	STUDENT GUIDE
		strongest/ quickest to build bridge.
SUMMARY	• Show Bridge building and inspection and ask why bridges are important to have for driving around your town.	• Pay attention to videos and ask frequent questions that will be later answered by MDOT engineers

REQUIREMENTS	RESOURCES	ESTIMATE TIME
• **Requirement 1** Learn about how bridges are built.	• **Resource 1** Video 1: "Engineering Adventures: Fort St Bascule Bridge" https://youtu.be/eV44Rxp7wKA	**Estimate Time:** 10-15 minutes
• **Requirement 2** Why MDOT inspects Bridges.	• **Resource 2** Video 2:"Engineering Adventures: Fort St Bascule: Bridge" https://youtu.be/eV44Rxp7wKA (K-2nd Grade) https://youtu.be/aPnn_nrGxkI (3rd Grade-6th Grade) https://youtu.be/jJdE_ARaTB8 (7th Grade to 12th Grade) • **Resource 3** Fort Street Bridge Construction https://www.youtube.com/watch?v=yFdIB9FVWdE	**Estimate Time:** 10-15 minutes
• **Requirement 3** Engineering Solutions to building a bridge	**Resource 4** Video 5: Fort Street Bascule Bridge Operational View https://www.youtube.com/watch?v=4S-AaE6M-4s	**Estimate Time:** 5 minutes
• **Requirement 4**		**Estimate Time:** 5 minutes

How the raised bridge operates

Total Time Frame: 45-60 Minutes

Michigan K-12 Standards, Science:

GRADE	1	2	3	4
MDE SUBJECT	**Engineering Design**	**Structure and Properties of Matter** **Engineering Design**	**Forces and Interactions** **Engineering Design**	**Engineering Design**
MDE CODES	K-2-ETS1-1 K-2-ETS1-2	2-PS1-1 K-2-ETS1-1 K-2-ETS1-2	3-PS2-1 3-5-ETS1-1 3-5-ETS1-2	3-5-ETS1-1 3-5-ETS1-2

GRADE	5	6-8	9-12
MDE SUBJECT	**Structure and Properties of Matter** **Earth's Systems** **Engineering Design**	**Structure and Properties of Matter** **Energy** **Human Impacts** **Engineering Design**	**Structure and Properties of Matter** **Engineering Design**
MDE CODES	5-PS1-4 5-ESS3-1 3-5-ETS1-1 3-5-ETS1-2	MS-PS1-3 MS-PS3-2 MS-ESS3-2 MS-ETS1-1	HS-PS2-6 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4

Explanation of How Civil Engineering applies to the Above Curriculum Codes:

Structure and Properties of Matter: Concentrate on the hydrothermal nature of concrete curing and the chemical reaction of water + cement + gravel. This reaction creates silicone-based crystals within the cement, gives off heat from the hydrothermal reaction, and requires consuming water to keep the reaction constant. A lot of MDOT projects use concrete and keeping the reaction constant through water fogging and temperature control is a high priority during construction.

Earth's Systems: Dams inherently effect the surrounding ecosystem and waterways for miles. To prevent yearly flooding and increase traffic access MDOT builds culverts, dams, and channels. Channeling waterways help give access to traffic and building development but may raise flooding risk if a structural failure occurs.

Energy: Water has inherent potential energy when being released from a high point. Equating water to electricity using the same mathematical equations is how MDOT bases the size of its waterway structures.

Human Impact: As more vehicle mobility is needed more waterway structures are needed. These structures are designed to minimally impact the surrounding ecosystem and waterway flow but structure failure causes sudden wide range impacts. Natural disasters will use the force of nature to revert waterways back to what they previously were, resisting or overtaking the structures in its path.

Roadways will also affect wildlife ecosystems, especially highways that may interrupt natural habitats. MDOT does many environmental studies and applies for DEQ permits to ensure minimal impacts to the surrounding ecosystem and habitats.

Engineering Design: MDOT uses numerous programs and engineering/tech teams to bring a project from design plans to a constructed structure. The most math and engineering intensive projects are usually for small renovations, emergency repairs, or long-standing travel issues. Simple questions such as "Can we had a extra traffic like on this cable without needing a stronger strain pole?" will lead into numerous calculations using physics and matched with construction specifications to a construction company bidding the job and ordering materials.

The most challenging issue is not the physics of the problem but what other structures or utilities are affected by the change. If you get larger aluminum or steel pole for more signals it will need a larger and deeper foundation that could impact utilities next to it. From here more calculations must be done to see if the utilities that may carry water/sewer pipes can be moved.