

CULVERT OR BRIDGE



Five Points to Consider Before
Choosing a Crossing Method

YORK
BRIDGE CONCEPTS
THE PREMIER TIMBER BRIDGE COMPANY



Inspired Living Case Study on page 4.

Stop Defaulting to Culvert Solutions, Consider a Timber Bridge Alternative.

Culverts can seem like a quick and easy fix to crossing water, wetlands, or floodways on a project. Although, sometimes the better option may be a bridge. Bridges can be more beneficial economically, ecologically, and aesthetically for a project. Consider how a bridge may satisfy your project needs using these five points before defaulting into a culvert solution.

Permitting: Bridges can take less time to permit than culverts

Culverts can be much more difficult to permit than bridges. This could mean an increased risk of delaying your schedule and project completion. Additionally, you could accrue time and expense for planning, permitting, or third-party verifications for alternative solutions.

This is how it works: The Army Corps of Engineers (Army Corps) requires that you receive their approval before developing in areas with wetlands or other bodies of water of public interest.¹ For the Army Corps to approve a project, they review the environmental impacts that could be caused by your project. If the Army Corps thinks that the amount of environmental damage to be caused is too great, they will require you to revise the project proposal to mitigate the impacts.

Revising a project proposal could mean having to use a different type of culvert, engaging in environmental mitigation efforts, or utilizing something completely different, like a bridge. Typically, a bridge solution can significantly reduce, or in some cases eliminate the impacts that can be a cause for permit denial. Some projects are not subject to Army Corps approvals, but they will require an environmental assessment and approval by a similar local or regional authority. In either jurisdiction, these revisions can prolong a project and in turn cost more money.

Five Points to Consider

- Permitting
- Environmental Impacts & Mitigation
- Cost
- Design, Maintenance, & Risk
- Aesthetics

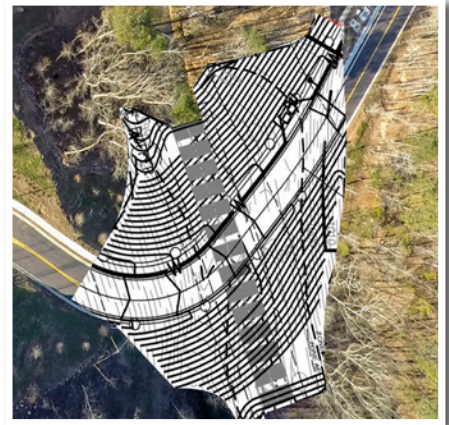
CASE STUDY

When a Bridge Reduces Environmental Impacts & Satisfies Water Flow Restrictions Better than a Culvert

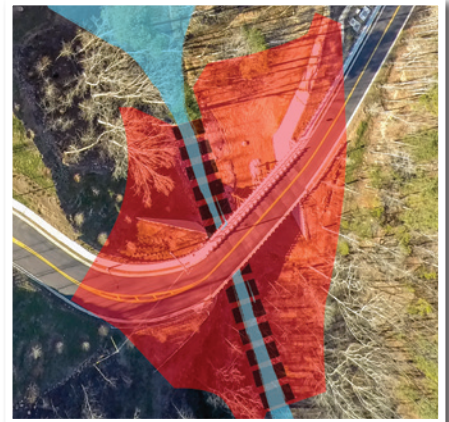
Our vehicular project, Inspired Living, shows how a bridge reduces impacts to the environment and water flow. The bridge was built at 40 feet above a flood plain to enter a senior living community. Originally, this project was considered to have several culverts installed rather than a bridge. However, with costs of mitigation included, the culvert project budget was going to be significantly higher than a bridge project. There was also significant fill required to raise the road nearly 20 feet in elevation to be above the 100-year flood level. Even with this planned increase in elevation, the 100-year flood flow test was not passed, and the culvert option was eliminated altogether. The final and accepted bridge solution reduced the impacts by 50,763 square feet, limiting environmental impacts to erosion control under the bridge and the fill areas to the bridge ends only. The natural flow is left uninhibited, and the area of flood impacts was limited to two 18 inch piling faces, ultimately increasing the flow clearance by 237 square feet within the flood area.

Not only was the bridge project less expensive, but it also allowed a large amount of land to be left to its natural state, which is key to maintaining undisturbed ecological systems. In turn, this leads to reduced environmental risks or repercussions at the bridge and downstream.

	Culvert	Timber Bridge
Permitting	Failed 100-year flood test	Permitted
Environmental Impacts & Mitigation	81,823 square feet <i>(see illustration)</i>	31,060 square feet Reduced by 62% <i>(see illustration)</i>
Cost	\$150,000 more than the bridge due to mitigation costs	Less expensive due to low environmental impact
Maintenance & Risk	Limited to 192 sq ft of flow within flood area & caused rise in 100-yr flood elevation	Provides 429 sq ft of flow within flood area
Aesthetics	Dirt and sod	Custom design options



Original Culvert Proposal



Environmental Impacts & Flow Restriction of the Proposed Culvert



Minimized Environmental Impacts & Flow Restrictions of the Timber Bridge Design

View images & specs:

www.ybc.com/inspired-living

Watch Video:

www.ybc.com/bridge-or-culvert-inspired-living/

Mitigation: Costs of culverts can skyrocket due to high levels of environmental impact

Obtaining a permit for culvert installation can result in high mitigation costs. The price of mitigation can push the costs of a culvert over the price of a bridge. Mitigation is the act of 'replacing' one environmental impact with an equivalent investment of another to offset the environmental impact of your project.^{7,8}

There are two main types of mitigation. One type is to pay impact fees that are typically associated with the square footage or acreage of the affected area. Another type is to reserve a comparable area on-site designated to mitigation alternatives like constructed or revitalized wetlands.⁷ In some cases, the cost of mitigation can end up being even more expensive than the culvert itself. This might be a good time to compare what the cost of a bridge might be.

Permitting authorities can be hesitant to approve a culvert because of its environmental impact, which includes waterway constraint and possible flood risk. These culvert impacts can include: clearing out the immediate natural surroundings, changing the flow of water and filling in the surrounding landscape with dirt to buffer the culvert while supporting the above roadway. Additionally, culverts affect the flow of water by creating a bottleneck. This bottleneck changes how the water flows on either side of it and can affect aquatic life, as well as change the pattern of the river.² These environmental impacts can often contribute to increased mitigation costs.³ Alternatively, bridges can allow for the natural flow of water, limiting their impact as compared to a culvert. This is why the Center for Environmental Excellence by AASHTO notes that "it is generally believed that culverts are more detrimental to streams than bridges", in its Designing for Environmental Stewardship in Construction & Maintenance Chapter.²

Culvert Alternative: Meadowlands Vehicular Bridge in Calabash, NC



Arch Culverts:

How do they compare to bridges?

If you are going to be spending more money on an arch culvert, it may be worth it to consider a timber bridge due to potential cost savings and the aesthetic elements it can bring.

Bridges and arch culverts are more similar in design as compared to bridges and classic culverts. This is because both have an open bottom that allows for the natural path of the body of water to continue.⁴ Permitting for both options will be easier because the environmental impact will be less. Additionally, both bridges and arch culverts are less maintenance than classic culverts because they eliminate the scenario of debris build-up.²

Generally speaking, the bridge and arch culvert are comparable crossing solutions both involving advanced design, and construction.⁵ However, the bridge has a greater potential for spanning – up to 120 linear feet for pedestrian bridges and 100 linear feet for vehicular bridges. Common arch culverts average spans top out around 48 feet.⁹

Design, Maintenance, & Risk: The resiliency of a timber bridge may surprise you

There are three interrelated things to consider when evaluating the functional longevity of a bridge or culvert solution: design, maintenance, and risk.

What is it about design that affects resiliency in a bridge vs. a culvert? A culvert is often a cookie cutter element that can significantly alter the natural processes. In addition, a culvert is sometimes designed to accommodate flow but not necessarily clear the 100-year flood elevation; meaning that in some cases the 100-Year Flood Elevation can exceed the designed roadway elevation and during extreme flooding, excess water is then expected to cross the roadway.¹⁰ Alternatively, bridges are typically designed with bridge's low chord above the 100-Year Elevation. A YBC bridge design is always recommended to be a minimum of 12 inches above the 100-Year Flood Elevation. This element of bridge design helps to increase flood flow area, clearance for debris and reduces the overall risk of adverse impacts during flood events.

What is typical for responsible maintenance of a bridge vs. a culvert? It's important to note that **all** roadways require a general level of maintenance, including keeping path of travel clear, maintaining the surrounding areas, and performing routine inspections. For a YBC timber bridge, the low-maintenance recommendations include every 2 to 4 years general tightening of fasteners and update the coatings. In contrast, culverts may require a frequent cleaning out of debris to prevent clogging. Additionally, all crossings typically require an inspection about every two years. The frequency of inspection depends on the legal requirements per state.

Now that the design and maintenance roles have been evaluated for bridges vs. culverts; how do they influence risks? As far as risks are concerned, there are two levels of risk: the risk of improper maintenance and risk of design failure. An improperly maintained bridge or culvert of any type runs the risk of a reduced life span and capacity that's attributed to negligence. However, in the case of a YBC bridge, if low-maintenance design elements and regular inspections recommendations are followed, then it is unlikely to pose risks of hidden threats. Alternatively, an improperly maintained or clogged culvert can collapse and cause flooding, roadway failures, or other harmful environmental impacts.⁶ In the event of flooding, which one of the greatest risks of nature that a bridge or culvert design will be subjected to, the weather intensities are greater than average conditions. When exposed to flooding, a bridge design has a reduced risk of failure because it can traditionally withstand flooding better than a culvert due to design requirements and increased clearances.⁷ In contrast, a culvert design inundated with increased flow and accompanying debris can be adversely impacted and potentially fail under the heightened storm conditions.¹⁰



Iconic Parkview on Peachtree mixed-use development entrance attracts residents and visitors on a busy road in North Atlanta.

CASE STUDY

After the Culvert Collapses: How a Bridge Solution Minimizes Flood Risks



Collapsed culvert due to flooding. 186 sq. ft. flow area of clearance.



Timber bridge conceptual mock up with unrestricted water flow.
350 sq. ft flow area of clearance (47% more flow area than a culvert).

■ Permitting

The bridge solution alleviates concerns regarding another culvert collapse.

■ Environmental Impacts & Mitigation

The bridge provided nearly 165 sq. ft. of increased flow clearance within flood area. Mitigation was not a factor in this project.

■ Cost

The bridge was less expensive than a replacement culvert.

■ Maintenance & Risk

The bridge reduces maintenance requirements of stream area and increases flood flow area. This, in turn, reduces flooding risks.

■ Aesthetics

The bridge opens up the stream providing an artistic and functional element to replace the failed culverts.

The Timber Bridge Advantage

- Save time on permitting
- Minimize environmental impact
- Decrease mitigation costs
- Reduce the risk of water flow restriction & flooding repercussions
- Create an iconic crossing for your project

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Aesthetics: A YBC timber bridge can create an iconic crossing for your project

A York Bridge enhances the style of your project which is a key element that most culverts can lack. At YBC, we synergize with you to customize your crossing. Culverts are common solutions and many times treated as a mundane or overlooked functional feature. In turn, a Decero™ designed York Bridge is something that is guaranteed to catch people's eye, while remaining equally if not more functional than the culvert. By incorporating a YBC timber bridge, you give your project something unique for people to talk about and enjoy while possibly reducing your costs.

In Project Planning, It's Good to Have Options.

Feel free to visit www.ybc.com to see an abundance of comprehensive timber bridge galleries to assist with planning for your next project. Our bridges have been custom designed for our clients to meet their needs. We have enhanced the style and functionality of many residential, commercial, and mixed-use developments. A timber bridge might be your cost-competitive and environmentally-sensitive solution.

SOURCES:

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