

BULLETIN #20:

Building Bridges on the Highway 427 Expansion Project



In 2019 there was significant progress on bridge work for the Highway 427 Expansion Project. Over the past few months you may have seen trucks driving to the Highway 427 expansion site with long concrete loads. These concrete beams, called girders, form an important part

of the bridges that are being constructed. This bulletin will explain the major components of the bridges built across the project, and showcase some photographs of different sections of bridges from across the Highway 427 expansion site.



Girders installed over West Robinson Creek.

Bridge Structures

Bridges comprise three main sections: the foundation, the substructure and the superstructure. The foundation is responsible for supporting the weight of the substructure and superstructure and transferring the load into the ground. The substructure is designed to support the superstructure and transfer the

weight of the superstructure into the foundation. The superstructure is used to support traffic driving across the span of the bridge.

The foundation consists of piles and footings. The substructure consists of abutments and piers. The superstructure consists of girders and the bridge deck.

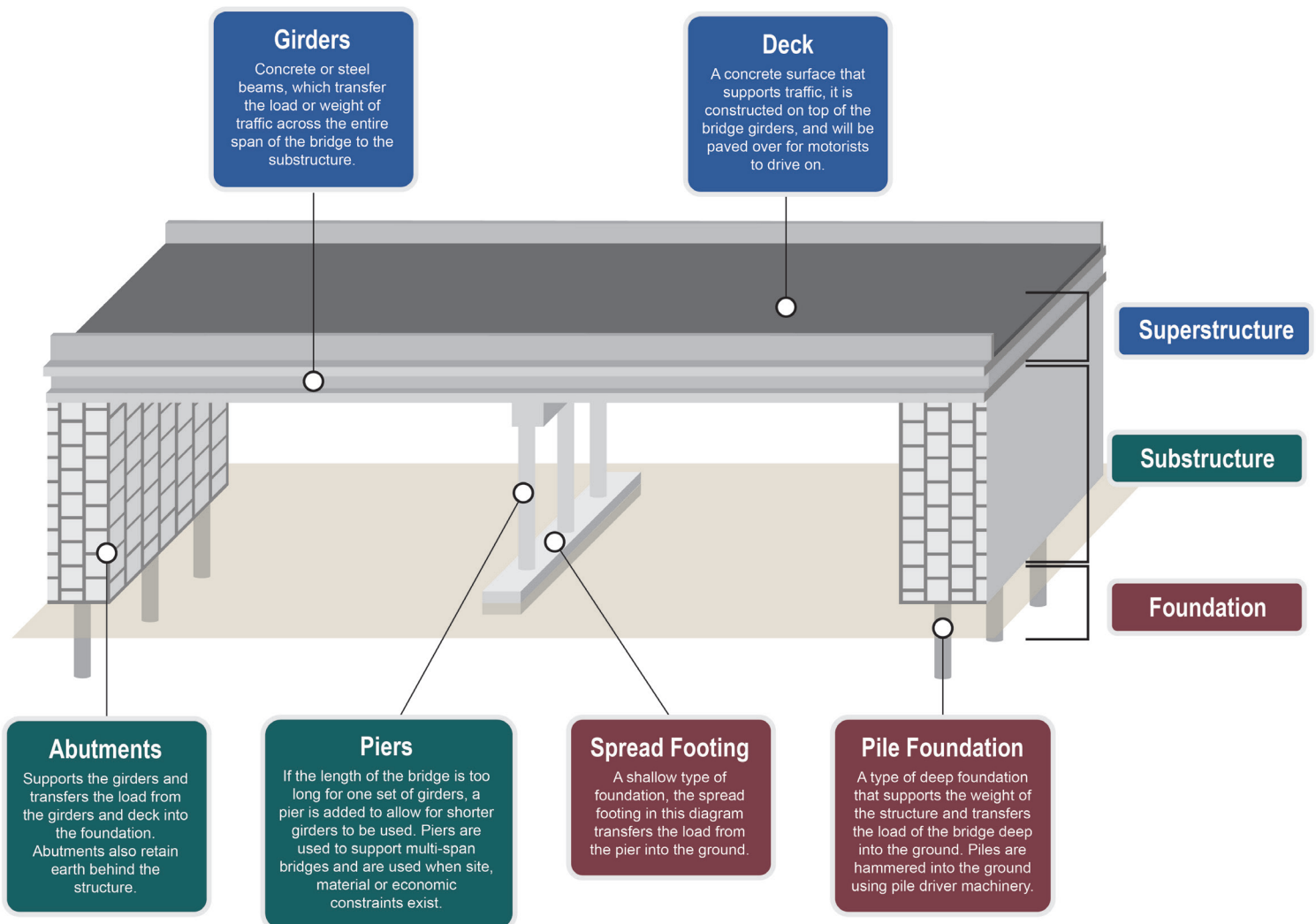


Diagram showing the foundation, substructure, and superstructure of a bridge.

Foundation

A bridge foundation supports the substructure and the superstructure and transfers their weight into the ground. There are shallow and deep types of foundations. One method of constructing a deep foundation includes pile driving, and one

method used for shallow foundations includes spread footings. A photo of piles (structural metal beams) that have been driven into the ground for a deep foundation of a bridge is shown below.



A photo of piles for a deep bridge foundation that were installed in January 2019.

A photo of piles for a deep bridge foundation at Rainbow Creek.



The Substructure

The substructure is the lower section of the bridge. It consists of abutments and piers. The abutments are the end sections of the bridge and piers are used in the centre of the bridge

if the span of the bridge is too long for one set of girders. The substructure is responsible for transferring the weight of the deck, girders, and traffic on the bridge into the foundation.

Abutments & RSS Walls

This photo shows a bridge abutment at Highway 427 and Langstaff Road, with some concrete girders and the deck of the Langstaff bridge installed along its edge. The abutments are at both ends of the bridge and transfer the load of the deck to the ground. They also support the horizontal and vertical loads. An RSS (retained soil system) wall may be used to stabilize the soil at the abutment. RSS walls retain the material behind the substructure and may be used to support the roadway at the bridge approaches.



An abutment and RSS walls at the Langstaff Road bridge over Highway 427. The bridge's girders and deck (the superstructure) are installed along the top edge of the abutment.



Pier construction for the future alignment of Zenway Boulevard.

Piers

This photo shows construction progress of the pier that will support the future alignment of Zenway Boulevard. As part of the substructure, piers are typically constructed in the shape of column with a thick concrete mat, known as a pile cap, built atop the pier. They provide upright support to the structure and bridge. Girders are placed on top of the piers, which are only used if the span of the bridge is too long for one set of girders.

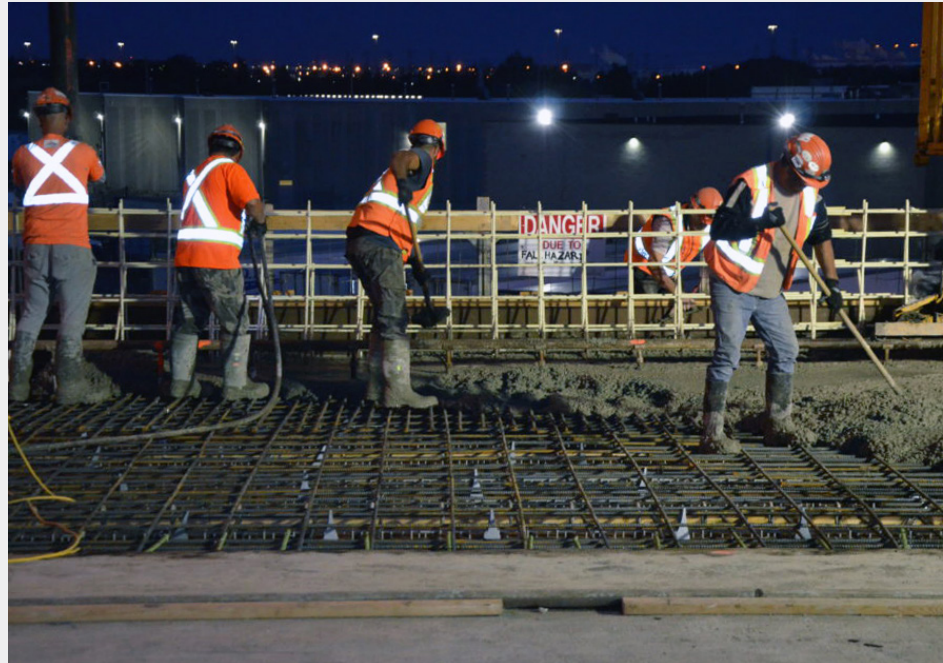
The Superstructure

The superstructure is the upper section of the bridge. It contains the most visible part of the bridge (the deck) but also the support underneath the deck that usually consists of girders. The type of bridges most commonly used in the Highway 427 Expansion are called

integral bridges. This means that the deck of the bridge is contiguous with the approach slab. This is better for long term maintenance of the bridge, especially during winters. The approach slab provides a transition between the road and the bridge abutment.

Deck

The deck of a bridge is made of poured concrete that connects the top of the bridge structure to the girders and the rest of the bridge. An example of concrete being poured to form the bridge deck can be seen on the right. Once girders are placed on top of the bridge substructure (abutments and piers), concrete deck panels, wood formwork, and rebar is laid prior to pouring concrete. Concrete is poured to connect everything together. Eventually the deck will be paved over so that motorists can drive on the bridges.



Pouring of a bridge deck at the bridge over the CN Railway.



Girders installed at Langstaff Road. The girder is called an I-beam structure because the beam is shaped like an I.

Girders

Girder installation on many of the Highway 427 Expansion structures began in August 2019. Girders are steel or concrete I-beam structures. These girders shown in the photo on the left are the ones installed at Langstaff Road, however the girders used over Rainbow Creek are some of the longest ever constructed in Ontario, at over 45 meters long.

How It All Comes Together

Once the foundation has been laid, the substructure of the bridge is ready, and the piers and abutments are in place, construction of the superstructure begins. Girders are installed on top of the piers or abutments, and workers begin the construction of wooden forms for the deck. This can be seen in the photo on the right. Once the wooden forms are built for the deck, concrete will be poured on top of the girders, creating the concrete deck of the bridge. This concrete deck will then be paved for motorists to drive on.



A view of the wooden forms that are being built on the girders to allow for the pouring of a concrete deck over the CP Rail tracks.

What is the Highway 427 Expansion Project?

The Highway 427 Expansion project will extend the highway 6.6 km, from Highway 7 to Major Mackenzie Drive and widen the existing highway to 8 lanes between Finch Avenue and Highway 7.

Who is LINK427?

LINK427 is the consortium selected by the Ministry of Transportation (MTO) and Infrastructure Ontario (IO) to design, build, finance, and maintain the Highway 427 widening and extension.

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