HARRIS COUNTY FLOOD CONTROL PROJECT ID G103-38-00-E001

KINGWOOD DIVERSION DITCH IMPROVEMENTS PER

BRIDGE EVALUATION REPORT

FEBRUARY 7, 2022

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February 7, 2022

Mr. Zafar Ahmed
Harris County Flood Control District
9900 Northwest Freeway
Houston, TX 77092

Re: Harris County Flood Control Project ID G103-38-00-E001 Kingwood Diversion Ditch Improvements PER

Dear Mr. Ahmed:

As part of the preliminary engineering phase, please see the attached bridge evaluation for your review and reference. Four roadway bridges and one pedestrian bridge currently crossing the Kingwood Diversion Ditch within the project limits were evaluated. This evaluation was based on structural integrity and current conditions. A summary of this evaluation can be found in the report.

Sincerely,
NEEL-SCHAFFER, INC.

David J. Hebert, P.E
Structural Engineering Manager, Southwest Region

Contents

Introduction

The proposed improvements to the 4-mile Kingwood Diversion Ditch include channel modifications and flow diversion from Bens Branch, as well as the purchase of additional land to construct a new outfall to the West Fork San Jacinto River. The anticipated reduction in water surface elevations along the Kingwood Diversion Ditch and Bens Branch from the proposed improvements would result in the removal of the 100-year stream inundation area from 62 structures and would allow for local drainage improvements that could benefit an additional 586 historically flooded structures.

Seven bridges could be impacted by ditch improvements and changes in flow pattern. The impacted bridges are as follows:

- Northpark Drive (west bound)
- Northpark Drive (east bound)
- Kingwood Drive (west bound)
- Kingwood Drive (east bound)
- Greenbelt Trails Pedestrian Bridge
- Walnut Lane
- Deer Ridge Estates Blvd.

The proposed improvements require an evaluation of all existing bridges crossing Kingwood Diversion Ditch to determine if bridge replacement is required. Northpark Drive, including each bridge, is currently under construction with improvements and bridge replacement under a separate project / contract. Evaluation of the remaining bridges are included in this project.

A bridge evaluation was recently completed for each of the 4 roadway bridges crossing the Kingwood Diversion Ditch. The intent of the evaluation was to include the review of existing drawings and data provided by Harris County Flood Control District, onsite inspections, review of past inspections and bridge ratings and Harris County and TxDOT design specifications and guidelines. The bridge evaluations would identify substandard conditions. Upon completion of the hydraulic analysis, each bridge will be evaluated for anticipated flow to identify insufficient lengths to accommodate the Kingwood Diversion Ditch Improvements.

Existing bridge drawings and inspection and maintenance reports were not readily available or provided by Harris County Flood Control District (HCFCD). Thus, the evaluation relied heavily on existing Federal Highway Administration's (FHWA) National Bridge Inventory (NBI) inspection reports and a field evaluation. Bridge data provided in the NBI bridge inspection reports were compared with field observations and measurements. An initial site visit was made on March 1, 2021, at the time of the project kick-off. A second site visit was made on October 8, 2021, to observe existing bridge conditions.

Bridge Rating Method

NBI evaluations follow a general coding system of 0 – 9. A breakdown of these codes are as follows.

- 9 New Condition (No Deficiencies)
- 7,8 Good Condition
- 5,6 Fair Condition

- 4 Poor Condition
- 3 Serious Condition
- 2 Critical Condition
- 1 Imminent Failure Condition
- 0 Failed Condition (Bridge Closed)

NBI Sufficiency Rating is a method of evaluating highway bridge data by calculating four separate factors to obtain a numeric value which is indicative of bridge sufficiency to remain in service. The result of this method is a percentage in which 100 percent would represent an entirely sufficient bridge and zero percent would represent an entirely insufficient or deficient bridge.

The Greenbelt Trails Pedestrian Bridge that crosses Kingwood Diversion Ditch does not fall under FHWA jurisdiction, therefore no inspection and rating data is available. The evaluation was limited to field observations and measurements, data provided on the bridge nameplate and bridge manufacture standards.

Kingwood Drive

The **Kingwood Drive** crossing, constructed in 1970, includes twin bridges for eastbound (NBI structure no. 121020B36488004) and westbound (NBI structure no. 121020B36488003) traffic. Each bridge has an overall length of 144 feet and a width of 32 feet with a roadway curb width of 24 feet. Bridge spans are arranged in 4 spans at lengths of 36 feet. Each bridge span includes 8 ~ 48-inch pre-stressed concrete T-beams with a cast in place wearing surface. Spans are supported on reinforced concrete abutments and pier caps, each with 4 ~ 16-inch precast pre-stressed concrete (PPC) piles. Pile depths are unknown although data provided for the nearby similar bridge span (Walnut Lane) suggests that pile lengths are approximately 45 feet. Embankment protection is provided by concrete slope paving under each bridge; continuous from east bound and west bound lanes.

A review of NBI inspection reports show the last inspection was completed in August of 2017 and records list an ADT of 32,070 based on 2012 traffic counts. The most recent inspection report and load rating lists the following for each bridge:

- General Condition: **Fair**
- Deck: Satisfactory
- Superstructure: Good
- Substructure: Satisfactory
- Sufficiency Rating: **64.3**

General condition of each bridge remains **fair** today. Normal wear and tear and weathering is present, although no major cracks or deficiencies are visible. Each bridge deck appears to be performing well. Bridge end joints are functioning properly. Existing pipe and utility hanger supports along bridge appear in good shape. Bridge end bearing pads show extreme wear but are still in-tact. There is concrete pitting on concrete T-beams. This is common from construction and does not appear to have gotten worse or present any issues. Bridge interior bearing pads are not visible. No visible evidence of settlement or structural concerns currently.

The most recent bridge inspection in August of 2017 noted the following:

- Bank is beginning to slump
- River control devices and embankment protection have widespread minor damage
- Minor stream bed movement is evident
- Debris is restricting channel slightly
- Bridge foundations determined to be stable for assessed / calculated scour condition

West bank concrete slope paving has severe cracking present most prevalent under west bound bridge and between bridges. Bottom section has completely cracked and has fallen off. Scour and undermining of concrete is evident and likely progressing at a fast rate. There is minor silt and debris present on concrete slope paving. East bank concrete slope paving has minor cracking. General concrete condition is much better than west bank concrete slope paving. There is major silt and debris present. General condition of slope paving is **poor**.

There is a large amount of silt and debris in the channel near the bridge. Bent No. 3, which sit in the middle of the existing channel, have silt and debris surrounding each pile. This is more prevalent on the east side. General channel condition is **poor**.




Walnut Lane

The **Walnut Lane** crossing, constructed in 1975, includes a single bridge for both eastbound and westbound (NBI structure no. 121020B67425001) traffic. The bridge has an overall length of 120 feet and a width of 36 feet with a roadway curb width of approximately 28 feet. Bridge spans are arranged in 3 spans at lengths of 40 feet. Each bridge span includes 9 ~ 48-inch pre-stressed concrete box-beams with a cast in place wearing surface. Spans are supported on reinforced concrete abutments and pier caps, each with 5 ~ 16-inch precast pre-stressed concrete (PPC) piles. Pile depths are unknown although data provided for the nearby similar bridge span and construction date (Deer Ridge Estates Blvd.) suggests that pile lengths are likely 45 feet. Embankment protection is provided by rip rap under the bridge; primarily around piles of intermediate bents sitting in the channel.

A review of NBI inspection reports show the last inspection was completed in August of 2017 and records list an ADT of 2,000 based on 2012 traffic counts. The most recent inspection report and load rating lists the following for each bridge:

- General Condition: **Fair**
- Deck: Satisfactory
- Superstructure: Good
- Substructure: Satisfactory
- Sufficiency Rating: **81.3**

General condition of the bridge remains **fair** today. Normal wear and tear and weathering is present, although no major cracks or deficiencies are visible. The bridge deck has minor cracks and spalling present. Standing water at curbs indicate poor deck drainage. Bridge end joints are in good condition and are functioning properly. Existing pipe and utility hanger supports on south side of bridge appear in good condition. Existing pipe support (independent of bridge) on north side of bridge appear in good condition. Bridge bearing pads are not visible. No visible evidence of settlement or structural concerns currently.

The most recent bridge inspection in August of 2017 noted the following:

- Bank protection is in need of minor repairs
- River control devices and embankment protection have a little minor damage
- Banks and/or channel have minor amounts of drift
- Bride foundations determined to be stable for assessed or calculated scour condition

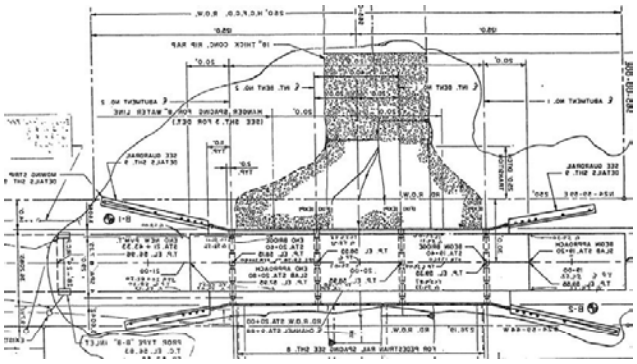
West bank rip rap concentrated around intermediate piers. No rip rap is present under Span 1 near end abutment. Bank erosion is present. East bank rip rap concentrated around intermediate piers. Very little rip rap is present under Span 3 near end abutment. No visible bank erosion is present. General east bank condition is better than west bank condition. General condition of bank and rip rap is **fair**.

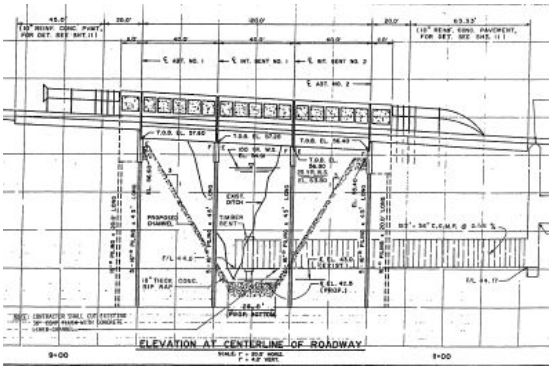
There is major silt and debris present. Although some rip rap has fallen into channel, no major debris is present. General condition of bank and channel is **fair**.




Deer Ridge Estates Blvd.

The **Deer Ridge Estates Blvd.** (Deer Springs Dr.) crossing, constructed in 1975, includes a single bridge for both eastbound and westbound (NBI structure no. 121020B18778010) traffic. The bridge has an overall length of 120 feet and a width of approximately 36 feet with a roadway curb width of approximately 27 feet. Bridge spans are arranged in 3 spans at lengths of 40 feet. Each bridge span includes 8 ~ 52-inch pre-stressed concrete box-beams with a cast in place wearing surface. Spans are supported on reinforced concrete abutments and pier caps, each with 5 ~ 16-inch precast pre-stressed concrete (PPC) piles. A provided drawing (Sheet 2 of 8; Job No. 931-A) shows pile lengths of 45 feet. Based on this information and field observation, pile depths at interior bents would be approximately 36 feet below existing bank elevation. Embankment protection is provided by rip rap under the bridge. West bank rip rap remains in place for the most part. East bank rip rap has washed down the bank.





A review of NBI inspection reports show the last inspection was completed in November of 2017 and records list an ADT of 200 based on 2012 traffic counts. The most recent inspection report and load rating lists the following for each bridge:

- General Condition: **Good**
- Deck: Good
- Superstructure: Very Good
- Substructure: Good
- Sufficiency Rating: **89.8**

General condition of the bridge remains **good** today. Normal wear and tear and weathering is present, although no major cracks or deficiencies are visible. The bridge deck has minor cracks and spalling present. Bridge end joints are in good condition and are functioning properly. Existing pipe and utility hanger supports on north side of bridge appear in good condition. Existing pipe and utility hanger supports on south side of bridge appear in good condition. Bridge bearing pads are not visible. There is concrete pitting on concrete piles. This is common from construction and does not appear to have gotten worse or present any issues. No visible evidence of settlement or structural concerns currently.

The most recent bridge inspection in August of 2017 noted the following:

- Bank protection is in need of minor repairs
- River control devices and embankment protection have a little minor damage
- Banks and/or channel have minor amounts of drift
- Bridge foundations determined to be stable for assessed or calculated scour condition

West bank rip rap remains in place for the most part under Span 1 although it should be noted that there is a noticeable difference in rip rap placement from March to October. No visible bank erosion at end abutment is present. Rip rap is present at concrete piles at intermediate bent with very minimal scour present. East bank rip rap has washed down embankment. No rip rap is present under Span 3 near end abutment although bank remains in stable condition. No visible bank erosion at end abutment is present although scour is present at concrete piles at intermediate bent.

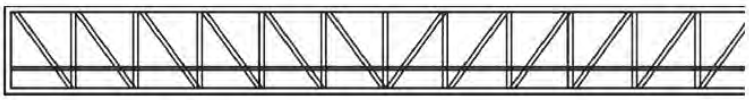
General west bank condition is better than east bank condition. General condition of bank and rip rap is **fair**.

There is minor silt and debris present, largely due to the accumulation of fallen rip rap. General condition of bank and channel is **fair**.

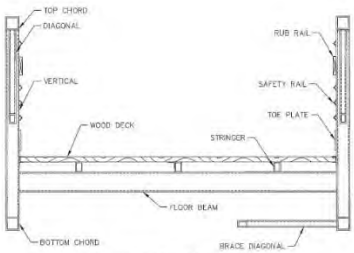



Greenbelt Trails Pedestrian Bridge

The **Greenbelt Trails Pedestrian Bridge**, part of Kingwood's Greenbelt Trails System (Bridge 1530), is located east of Kingwood Pines Hospital and west of Lake Village Drive. The bridge is a pre-engineered / prefabricated steel truss by Continental Bridge (Contech Engineered Solutions LLC) who has been designing and constructing pedestrian bridges since 1974. Date of construction is not noted on the bridge name plates although it is suspected to have been sometime in the late 1970's. The pedestrian bridge is a Connector Standard "Express" Truss. The truss has 20 bays with an overall span length of approximately 145 feet and a clear width (inside of railings) of 5'-10". The truss is constructed of welded steel tube for the top chords, bottom chords, floor beams, struts and stringers. Welded steel angle is used for vertical and horizontal bracing along with longitudinal guardrail gap fillers. Steel plate is used for toe plates and end joints. The bridge was installed with a wood deck and rub rail. The truss is supported on concrete end abutments that are likely pile supported.



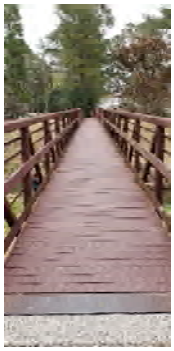
Connector® Standard Truss



Connector® - H-Section

The bridge, primary used by walkers, runners and bikes, has a vehicle load limit of 5,000 lbs. Motorized vehicles are not allowed on the bridge. As a pedestrian bridge, a scheduled inspection and maintenance does not fall under similar vehicular bridge requirements. The general condition of the bridge is **good**. The truss members are in good condition although surface rust is present. Structural welds and in good condition. It appears that the wood deck and rub rail had been recently replaced with solid, composite deck boards. These boards are in very good condition and often carry a 20 to 25-year life span. Concrete end abutments are in good condition. Noticeable deflection (bouncing) is present when a single runner crosses the bridge.

The bridge span is longer than the current channel width by approximately 20 feet. The west abutment sits at the top of bank. The east abutment sits approximately 20 feet east of the top bank. Although no rip rap or bank protection is present, the general condition of each bank and channel remains **good**.



Summary

The Kingwood Drive crossing has a General Condition: Fair and a Sufficiency Rating: 64.3 (2017) with an ADT: 32,070 (2012). The Walnut Lane crossing has a General Condition: Fair and a Sufficiency Rating: 81.3.3 (2017) with an ADT: 2,000 (2012). The Deer Ridge Estates Blvd.

crossing has a General Condition: Good and a Sufficiency Rating: 89.8 (2017) with an ADT: 200 (2012).

Overall bridge lengths for each bridge are:

- Kingwood Drive (144 feet)
- Walnut Lane (120 feet)
- Deer Ridge Estates Blvd. (120 feet)
- Green Trails Pedestrian Bridge (145 feet)

Recommendations

Harris County Flood Control District should ensure that each bridge is in alignment with Federal Highway Administration (FHWA) and Texas Department of Transportation (TxDOT) bridge inspection and load rating requirements. The primary purpose of bridge inspections is to ensure public safety. The secondary purpose is to preserve the remaining life in our structures through the early detection and addressing of deficiencies. A bridge is defined as a structure, including supports, erected over a depression or an obstruction, such as water, a highway, or a railway; having a roadway or track for carrying traffic or other moving loads; and having an opening measured along the center of the roadway of more than 20 feet between inside faces of abutments, spring lines of arches, or extreme ends of the openings for multiple box culverts, or multiple pipes that are 60 inches or more in diameter and that have a clear distance between openings of less than half of the smallest pipe diameter.

Federal law governs the requirements of the TxDOT Bridge Inspection Program. The United States Code (23 U.S.C. 151) requires the Secretary of Transportation, in consultation with State transportation departments, to establish national bridge inspection standards for the proper safety inspection and evaluation of all highway bridges. These requirements are spelled out in the Code of Federal Regulations (Part 650, Subpart C) and govern the National Bridge Inspection Standards (NBIS) through purpose, applicability, definition of terms, qualification of personnel, inspection frequencies, inspection procedures, inventory procedures, and supporting references.

Federal Highway Administration (FHWA) has developed 23 Metrics for the Oversight of the National Bridge Inspection Program. These metrics are a risk-based assessment of the performance of state bridge inspection programs and compliance with the NBIS. Each year, TxDOT's Bridge Inspection Program is audited by the FHWA for compliance on these metrics.

TxDOT's Bridge Inspection Program, as defined in the TxDOT Bridge Inspection Manual, follows or exceeds the requirements set forth by the FHWA. A detailed description of the data recorded is contained in the TxDOT Bridge Coding Guide. As defined in Section 4, routine inspections are those regularly scheduled, performed, and recorded in accordance with all the procedures described in Chapter 8 of the manual. Routine inspections should be conducted every twenty-four months for most bridges. Some bridges need more frequent inspections when conditions warrant.

Considering the general condition and sufficiency rating for each bridge crossing Kingwood Diversion Ditch, 2017 inspection data is outdated. The Kingwood Drive bridges have a General Condition that is fair and Sufficiency Rating of 64.3. Although structurally sound with no major structural defects, channel conditions are poor with concrete slope paving failure and scour present. Each bridge also has high traffic volume (32,070 in 2012). Updated traffic data will likely show an increase in traffic and yield a lower Sufficiency Rating. The Walnut Lane bridge has a General Condition that is fair and Sufficiency Rating of 81.3. Although structurally sound with no major structural defects, the bridge is showing wear. Bank erosion is also present. The bridge has a much lower traffic volume (2,000 in 2012). An updated inspection and load rating will likely yield a lower Sufficiency Rating. The Deer Ridge Estates Blvd. bridge has a General Condition that is good and Sufficiency Rating of 89.8. This bridge is generally in much better shape overall. Embankments and channel are in need of minor work. And the bridge has a very low traffic volume (200 in 2012). Updated traffic counts are expected to yield a minimal increase. Bridge replacement is not required with present day data.

The Greenbelt Trails Pedestrian Bridge is in good condition and is structurally sound. It appears that a recent bridge deck replacement has been made with composite deck boards that should last 20 years or more. The steel truss, along with structural welds, are in good shape, but the entire bridge has surface rust. It is highly recommended that the bridge is blasted and painted to preserve the structural members and ensure a long lifespan.

The necessary maintenance for each bride should be completed to ensure safe conditions. An overall review of channel conditions and proposed improvements, as part of the Hydrologic and Hydraulic (H&H) Study, may require changes to existing channel and banks that exceed the current limits of the existing bridges. Although current structural conditions may not warrant bridge replacement(s), the results of the H&H Study could supersede the structural conditions for one or more of the bridges crossing Kingwood Diversion Ditch.