

Preliminary Engineering Quiet Zones at Various Locations in Precinct 2

UPIN: 21102MF24101

Houston, Texas

Limits: From Fulton Street to W. Hardy Street Along the BNSF and UPRR Mainline Track

Prepared for: The Harris County Engineering Department

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07/08/2021



**Lockwood, Andrews
& Newnam, Inc.**
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TBPE Firm No. 2614

Executive Summary

The Harris County Engineering Department has retained Lockwood, Andrews & Newnam, Inc (LAN) to conduct a safety evaluation of 6 grade crossings in the city of Houston, Texas and identify safety issues, propose potential solutions, and provide an engineering estimate of probable cost for the potential establishment of a quiet zone to eliminate train horn noise.

LAN conducted a field visit of the project corridor on April 8, 2021 and photographs were taken of existing conditions of each grade crossing. This report summarizes the existing conditions of each grade crossing in the study corridor, notes traffic control device deficiencies as recommended in the Texas Manual on Uniform Devices (TMUTCD), and recommends supplementary safety measures that may be implemented at each grade crossing for a potential quiet zone in the corridor.

The 6 grade crossings are located along the BNSF Railway Belt Junction Line and Union Pacific (UPRR) Houston East Belt Subdivision in Harris County in the city of Houston, Texas. The project includes the following six active grade crossings along a single mainline track:

1. BNSF DOT# 287965D at Fulton Street
2. BNSF DOT# 287966K at Donlen Street
3. BNSF DOT# 287967S at Helmers Street
4. BNSF DOT# 287968Y at Irvington Boulevard
5. UPRR DOT# 287969F at W. Hardy Street
6. UPRR DOT# 287970A at W. Hardy Street

Table 1 below summarizes the existing conditions, safety deficiencies as it relates to the potential establishment of a quiet zone, and proposed safety improvements for each grade crossing in the study corridor.

Table 1. Grade Crossing Safety Evaluation Summary

Location	DOT#	Existing Conditions	Safety Deficiencies	Safety Recommendations
Fulton St	BNSF 287965D	<ul style="list-style-type: none"> ◆ Medians on both approaches ◆ Divided roadway--2 SB lanes & 1 NB lane ◆ Gates and flashing lights (Cantilever) ◆ Power-out indicators. ◆ W10-1 Signs on both approaches ◆ RR Xing pavement markings on both approaches ◆ Sidewalks on both approaches ◆ Stokes St is within 100 feet of crossing gate. ◆ Posted speed limit: 35 mph ◆ Stop lines near crossing gate within school zone 	<ul style="list-style-type: none"> ◆ Existing medians are not long enough to meet QZ requirements. Since an intersection is found withing 100' of each gate, the medians must be at least 60' from the gate arm. Neither median meets the minimum 60-foot length. ◆ Gate mechanism and foundation encroach in the sidewalk on SB approach and does not allow the minumum 4-ft clear width (PROWAG) continued around obstructions. 	<ul style="list-style-type: none"> ◆ Extend each of the existing medians to at least 60 feet from the gate arm (Non-traversable curbs). Note that extending the median on the NB approach will eliminate the EB left-turn movements from and onto Stokes Street. ◆ Replace faded RR pavement markings and stop lines. ◆ Realign Stokes Street to allow the existing median to be extended to 100 feet from the existing gate location. ◆ Reroute the sidewalk on the SB approach behind the gate foundation. ◆ Preliminary Cost Estimate: \$306,105
Donlen St	BNSF 287966K	<ul style="list-style-type: none"> ◆ Undivided 2-lane roadway ◆ Gates and flashing lights ◆ Power-out indicators. ◆ W10-1 Signs on both approaches ◆ No RR Xing pavement markings on either approach ◆ No sidewalks on either approach ◆ Roswell St is within 60 feet of crossing gate ◆ Frisco St is within 100 feet of crossing gate ◆ No posted speed limit (30 mph) ◆ 4% approach slopes ◆ W10-4 on Roswell St ◆ Faded stop lines 	<ul style="list-style-type: none"> ◆ At the time of the field inspection, pedestrians were observed crossing the RR track. Pedestrian facilities should be provided ◆ W10-4 sign missing on Frisco Street ◆ No RR Xing pavement markings on either approach 	<ul style="list-style-type: none"> ◆ Since the roadway is not wide enough to implement a non-traversable curb, channelization devices for a length of 100 feet are recommended. Roswell Street is within 60 feet of the SB crossing gate and must be closed, if channelization devices are implemented on this side of the roadway. ◆ Since Frisco Street is within 100 feet (Field measured distance was 90') of the NB crossing gate, the recommended channelization device must extend at least 60 feet from the NB crossing gate. ◆ Install stop lines and include RR Xing markings on both approaches. ◆ Install W10-4 sign on Frisco Street ◆ Preliminary Cost Estimate: \$43,888
Helmerts St	BNSF 287967S	<ul style="list-style-type: none"> ◆ Undivided 2-lane roadway ◆ Gates and flashing lights ◆ Power-out indicators. ◆ W10-1 Signs on both approaches ◆ No RR Xing pavement markings on either approach ◆ No sidewalks on either approach ◆ No posted speed limit (30 mph) in NB approach ◆ 4% approach slopes 	<ul style="list-style-type: none"> ◆ At the time of the field inspection, pedestrians were observed crossing the RR track. Pedestrian facilities should be provided ◆ No RR Xing pavement markings on either approach 	<ul style="list-style-type: none"> ◆ It is recommended that a channelization device of a length of 90 feet be provided in the NB approach. ◆ Provide 100-foot channelization devices in the SB ◆ Provide RR Xing pavement markings on both approaches ◆ Replace faded stop lines ◆ Preliminary Cost Estimate: \$47,111
Irvington Blvd	BNSF 287968Y	<ul style="list-style-type: none"> ◆ Divided 4-lane roadway ◆ Gates and flashing lights ◆ Power-out indicators. ◆ W10-1 Signs on both approaches ◆ RR Xing pavement markings on both approaches ◆ Sidewalks on both approaches ◆ Posted speed limit: 35 mph ◆ Bike lanes on both approaches ◆ Faded stop lines 	<ul style="list-style-type: none"> ◆ Sidewalks are not continuous over the track. ◆ Median near the track are at same elevation as the roadway and will not prevent motorists from driving around a lowered gate 	<ul style="list-style-type: none"> ◆ Install additional crossing panels to connect sidewalks across the track ◆ Close median opening on SB approach near the track and install curb to prevent motorists from driving around lowered gate. ◆ Install 6" curb on median on NB approach near track. ◆ Replace faded pavement markings ◆ Replace faded pavement markings on both bike lanes ◆ Preliminary Cost Estimate: \$189,605
W. Hardy St (Main)	UPRR 287969F	<ul style="list-style-type: none"> ◆ Divided 4-lane roadway ◆ Gates and flashing lights ◆ Power-out indicators. ◆ No W10-1 Signs on either approach ◆ No RR Xing pavement markings on either approach ◆ No Sidewalks ◆ Posted speed limit: 40 mph ◆ No stop lines 	<ul style="list-style-type: none"> ◆ No W10-1 signs ◆ No RR Xing pavement markings on either approach ◆ No stop lines on either approach 	<ul style="list-style-type: none"> ◆ Install W10-1 signs ◆ Install RR Xing pavement markings on either approach ◆ Install stop lines on either approach ◆ Remove existing raised median and replace with 2' raised median with 8" curb height ◆ Preliminary Cost Estimate: \$31,850
W. Hardy St (Connector)	UPRR 287970A	<ul style="list-style-type: none"> ◆ Divided 4-lane roadway ◆ Gates and flashing lights ◆ Power-out indicators. ◆ No W10-1 Signs on either approach ◆ No RR Xing pavement markings on either approach ◆ No Sidewalks ◆ Posted speed limit: 40 mph ◆ No stop lines 	<ul style="list-style-type: none"> ◆ No W10-1 signs ◆ No RR Xing pavement markings on either approach ◆ No stop lines on either approach 	<ul style="list-style-type: none"> ◆ Install W10-1 signs ◆ Install RR Xing pavement markings on either approach ◆ Install stop lines on either approach ◆ Remove existing raised median and replace with 2' raised median with 8" curb height ◆ Preliminary Cost Estimate: \$40,651

Background Information

Under the Train Horn Rule (49 CFR 222), the Federal Railroad Administration (FRA) requires that the train horn be sounded at all highway-rail grade crossings. Although the purpose of the sounding of the train horn is to warn motorists and pedestrians of an approaching train and prevent collisions, it frequently has a negative impact on residents' quality of life and economic development in the vicinity. The train horn rule also provides a methodology to create quiet zones and eliminate the need to sound the train horn at grade crossings, but the increased risks associated from the absence of the train horn must be mitigated with supplemental safety measures (SSM).

The subject project is located in Harris County in the city of Houston, Texas along the BNSF Railway Belt Junction Line and Union Pacific (UPRR) Houston East Belt Subdivision. The project includes six active grade crossings along a single mainline track. A field visit was conducted to assess existing safety conditions at each grade crossing and take field measurements and pictures. The table below lists the grade crossings in the project from west to east:

Street Name	Railroad	DOT #	Mile Post	Parallel Street Within 100 ft of Gate
Fulton Street	BNSF	287965D	58.56	Stokes Street
Donlen Street	BNSF	287966K	58.20	Roswell Street & Frisco Street
Helmets Street	BNSF	287967S	57.97	Private Driveway
Irvington Boulevard	BNSF	287968Y	57.72	Frisco Street
W. Hardy Street	UPRR	287969F	229.05	–
W. Hardy Street	UPRR	287970A	229.04	–

The single main track has an average of 10 through trains a day on the Belt Junction Line and 4 through trains a day on the UPRR Houston East Subdivision. Based on information obtained from the Federal Railroad Administration (FRA) grade crossing inventory database, all six grade crossings are equipped with constant warning detection. The single main track in the BNSF Belt Junction Line has a timetable speed of 20 mph. The UPRR grade crossing on the mail line has a timetable speed of 15 mph and the grade crossing on the BNSF to UPRR connection track has a timetable speed of 10 mph.

The Harris County Engineering Department has retained Lockwood, Andrews & Newnam, Inc (LAN) to conduct a safety evaluation in the aforementioned grade crossings and identify safety issues, propose potential solutions, and provide an engineering estimate of probable cost for the potential establishment of a quiet zone to eliminate train horn noise.

LAN conducted a field visit of the project corridor on April 8, 2021 and photographs were taken of existing conditions of each grade crossing. This report summarizes the existing conditions of each grade crossing in the study corridor and recommends supplementary safety measures that may be implemented at each grade crossing for a potential quiet zone in the corridor. **Figure 1** identifies all the grade crossings in the study corridor.

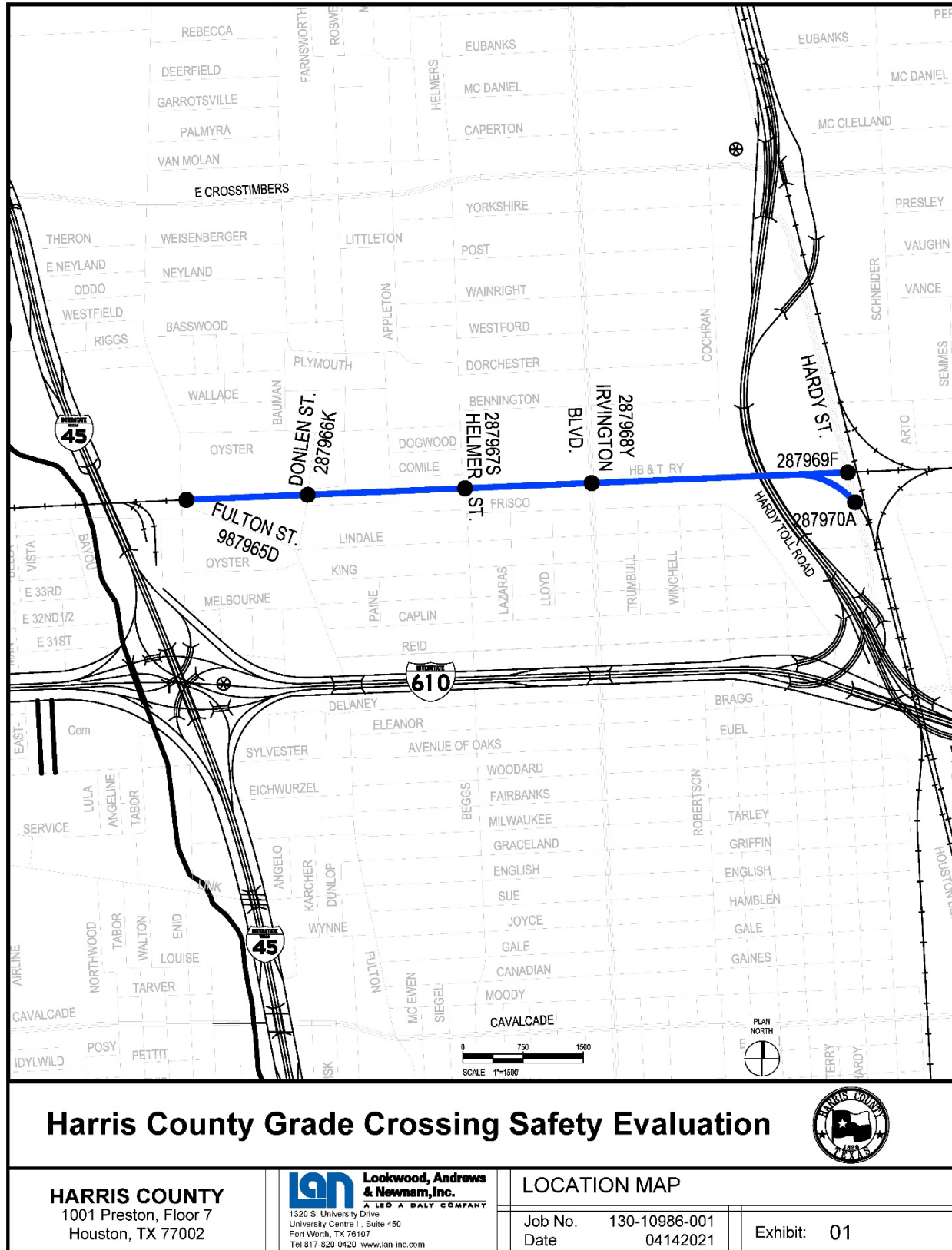


Figure 1 shows the project location and grade crossings in the study corridor.

BNSF Grade Crossing DOT# 287965D at Fulton Street

Existing Grade Crossing Conditions

Fulton Street is a 3-lane divided roadway that runs in a north to south direction. The northbound approach includes one lane and the southbound approach includes two lanes over the single mainline track. The approach grades to the grade crossing are less than 2% and raised medians are found in both grade crossing approaches. The posted speed limit on Fulton Street is 35 mph. The following signs and pavement markings were found on Fulton Street near the grade crossing as recommended in the TMUTCD:

- W10-1 signs on both approaches
- Faded RR Xing pavement markings on both approaches
- Faded stop lines on both approaches



Figure 2a. Fulton Grade Crossing



Figure 2b. Fulton Street at Stokes Street



Figure 3. Sidewalk on northbound Fulton Street



Figure 4. Sidewalk on southbound Fulton Street

It is noted that LAN did not have access to the railroad bungalow to analyze the existing train detection equipment and track design plans; however, the following active grade crossing equipment is available or visible from the public right-of-way:

- Automatic gates
- Flashing lights
- Warning electronic bells
- Crossbucks
- Power-out indicators
- Cantilever on southbound approach

Grade Crossing Safety Deficiencies

The existing raised medians along Fulton Street do not have the required length to meet the FRA's quiet zone requirements. Since an intersection is found within 100 feet of each crossing gate, the medians must be at least 60 feet from the crossing gate. Neither existing median meets the minimum 60-foot length.

The gate mechanism and foundation for the southbound approach encroach in the sidewalk and do not allow the minimum 4-foot clear width continued around obstructions for pedestrians as required by The Public Right-of-Way Accessibility Guidelines (PROWAG).

Grade Crossing Safety Recommendations

In order for this grade crossing to be part of a future quiet zone, the following supplementary safety measures (SSM) are recommended:

- Since Stokes Street is within 100 feet of the gate arm on the northbound approach, the exiting raised median must be extended at least 60 feet from the gate arm. Extending the existing raised median to 60 feet will eliminate the left-turn movements from and onto Stokes Street. Therefore, it is recommended that Stokes Street be realigned as shown in **Figure 5** to allow the existing median on the northbound approach to be extended to 100 feet. On the southbound approach,

the existing median may be extended to at least 60 feet without impacting the southbound U-turn.

- Reroute the existing sidewalk on the southbound approach behind the gate foundation as shown in **Figure 5** below.
- Replace RR pavement markings and stop lines
- Ensure gate arm length is within one foot of the raised median

In the future, consideration may be given to installing automatic pedestrian gates and exit gates at each sidewalk.

Estimate of Probable Construction Cost

The table below summarizes the estimated construction cost of the above recommended safety improvements.

Fulton St (DOT# 287965D)	Quantity	Unit	Unit Cost	Cost
Construction Cost Subtotal	-	-	-	\$ 212,850
Mobilization (15%)	1	LS	\$31,928.00	\$ 31,928.00
Construction Railroad Flagging	2	DAY	\$ 1,500.00	\$ 3,000.00
Contingency (10%)	1	LS	\$21,285.00	\$ 21,285.00
Railroad Protective Liability Insurance	1	LS	\$ 1,500.00	\$ 1,500.00
Railroad's Cost to Administer Quiet Zone	1	LS	\$10,000.00	\$ 10,000.00
Engineering Cost (12%)	1	LS	\$25,542.00	\$ 25,542.00
Total Estimated Project Cost				\$ 306,105.00

A more detailed cost estimate is provided in **Appendix A**.

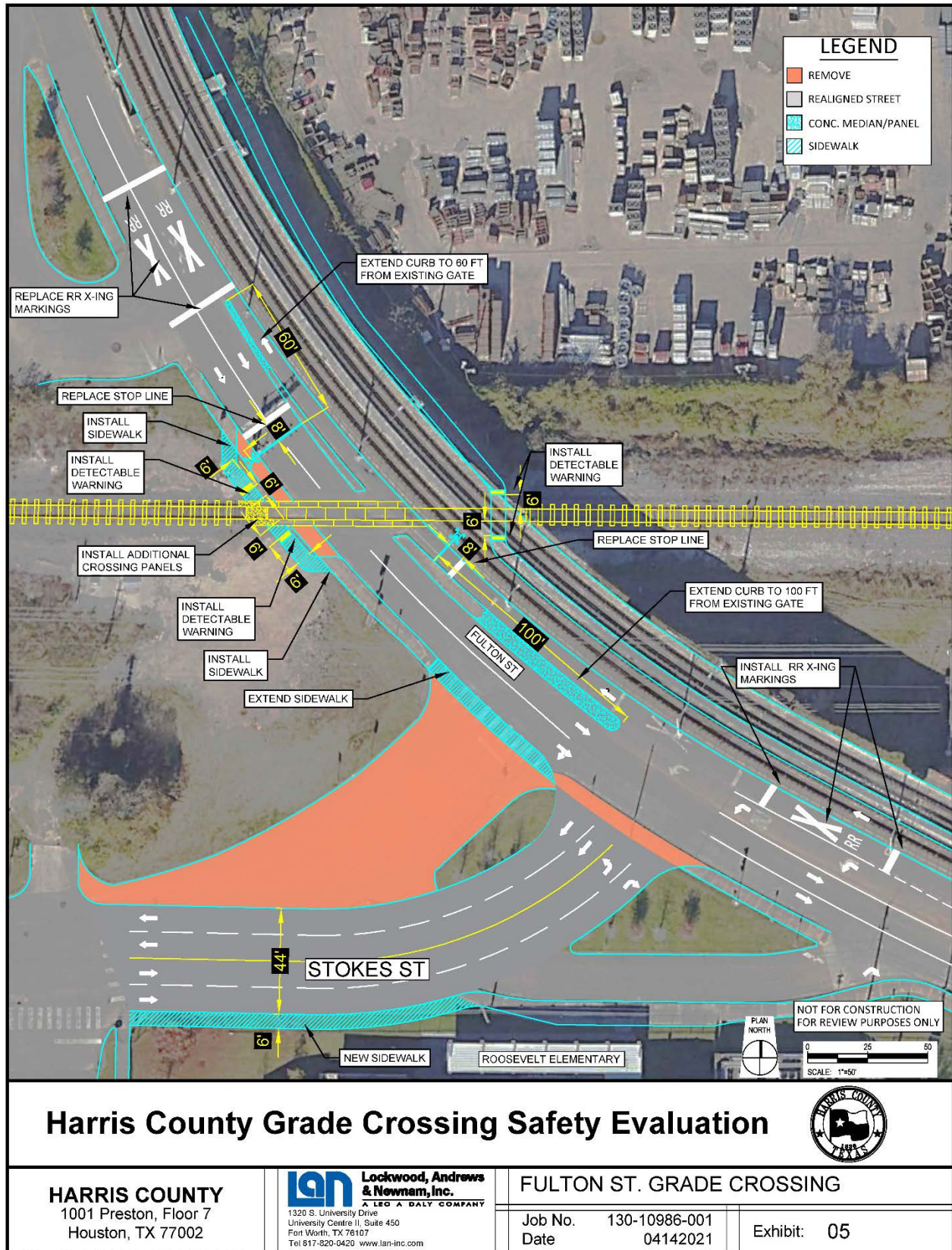


Figure 5. Fulton Street SSM Recommendations

BNSF Grade Crossing DOT# 287966K at Donlen Street

Existing Grade Crossing Conditions

Donlen Street is a two-lane, undivided roadway that runs in a north to south direction and intersects two residential streets near the grade crossing. No pedestrian facilities are available. The approach grades to the grade crossing are approximately 4%. Since no posted speed limit sign was found on Donlen Street, the speed limit is assumed to be 30 mph. The following signs and pavement markings were found on Donlen Street near the grade crossing as recommended in the TMUTCD:

- W10-1 signs on both approaches
- No RR Xing pavement markings on either approach
- Faded stop lines on both approaches
- Grade Crossing Advance Warning sign (W10-4) on Roswell Street



Figure 6. Grade Crossing at Donlen Street



Figure 7. Roswell Street Parallel to the Grade Crossing at Donlen Street



Figure 8. Frisco Street Parallel to the Grade Crossing at Donlen Street

Roswell Street is within 60 feet of the southbound crossing gate and Frisco Street is within 100 feet of the northbound crossing gate.

It is noted that LAN did not have access to the railroad bungalow to analyze the existing train detection equipment and track design plans; however, the following active grade crossing equipment is available or visible from the public right-of-way:

- Automatic gates
- Flashing lights
- Warning mechanical bells
- Crossbucks
- Power-out indicators

Grade Crossing Safety Deficiencies

There are no raised medians and the roadway is not wide enough to implement a non-traversable curb to prevent motorists from driving around a lowered gate. A grade crossing advance warning sign (W10-4) on Frisco Street is missing and stop lines at least 8 feet from the gate arm are not present on either grade crossing approach.

Grade Crossing Safety Recommendations

Since two intersections are found within 60 feet and 100 feet of a crossing gate, medians or channelization devices must have a length of at least 60 feet from the crossing gate arm. Since Roswell Street is 40 feet from the gate arm on the southbound approach, the FRA requires that the street be closed if the grade crossing is to be part a quiet zone.

Roswell Street as Right-In Right-Out Intersection

- Restrict Roswell Street to operate as a right-in right-out intersection.
- Install 100 feet of channelization devices on the southbound approach. It is noted that under this option, a quiet zone must be requested under Code of Federal Regulation Title 49 §222.39(b) – How a Quiet Zone is Established? **Figure 9** shows graphically the proposed safety improvements.
- Install at least 60 feet of channelization devices on the northbound approach as Frisco Street is within 100 feet of the northbound gate arm.
- Install a Grade Crossing Advance Warning sign (W10-4) on Frisco Street.
- Replace faded stop lines at least 8 feet from the gate arm on each approach.
- Install RR Xing pavement markings on both approaches.
- Ensure gate arm length is within one foot of the roadway centerline.
- As a long-term grade crossing improvement, it is recommended that pedestrian facilities be provided.

Estimate of Probable Construction Cost

The table below summarizes the estimated construction cost of the above recommended safety improvements.

Donlen St (DOT# 287966K)	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Cost</u>
Construction Cost Subtotal	-	-	-	\$ 21,451
Mobilization (15%)	1	LS	\$ 3,218.00	\$ 3,218.00
Construction Railroad Flagging	2	DAY	\$ 1,500.00	\$ 3,000.00
Contingency (10%)	1	LS	\$ 2,145.00	\$ 2,145.00
Railroad Protective Liability Insurance	1	EA	\$ 1,500.00	\$ 1,500.00
Railroad's Cost to Administer Quiet Zone	1	EA	\$10,000.00	\$ 10,000.00
Engineering Cost (12%)	1	LS	\$ 2,574.00	\$ 2,574.00
Total Estimated Project Cost				\$ 43,888.00

A more detailed cost estimate is provided in **Appendix A**.

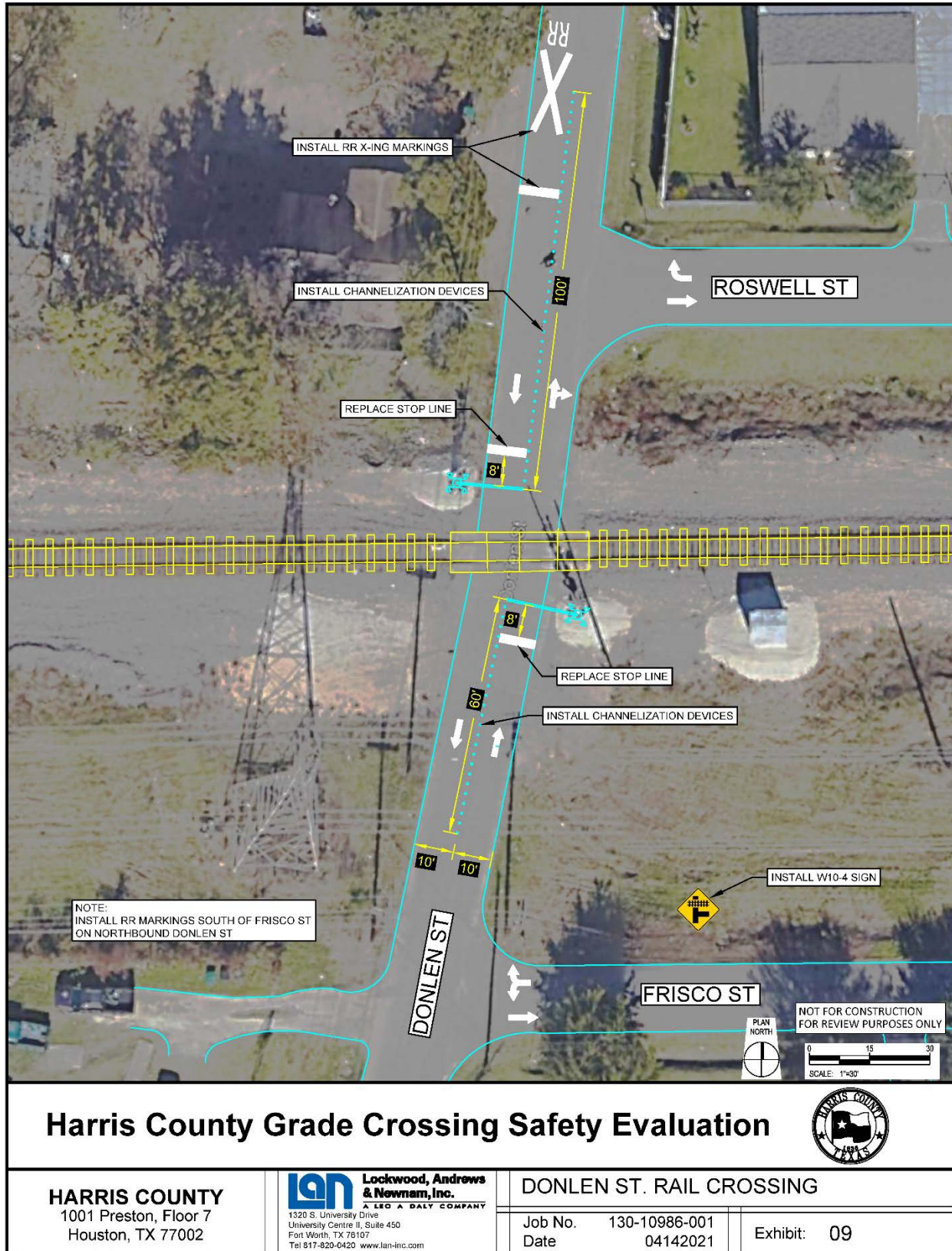


Figure 9. SSM Option 2 for Donlen Street

BNSF Grade Crossing DOT# 287967S at Helmers Street

Existing Grade Crossing Conditions

Helmers Street is a two-lane, undivided roadway that runs in a north to south direction without intersecting any streets within 100 feet. No pedestrian facilities are available on either side of Helmers Street. The approach grades to the grade crossing are approximately 4%. Since no posted speed limit sign was found on Helmers Street, the speed limit is assumed to be 30 mph. The following signs and pavement markings were found on Helmers Street near the grade crossing as recommended in the TMUTCD:

- W10-1 signs on both grade crossing approaches
- No RR Xing pavement markings on either grade crossing approach
- No stop lines on either grade crossing approach



Figure 10. Grade Crossing at Helmers Street (Northbound)



Figure 11. Grade Crossing at Helmers Street (Southbound)

It is noted that LAN did not have access to the railroad bungalow to analyze the existing train detection equipment and track design plans; however, the following active grade crossing equipment is available or visible from the public right-of-way:

- Automatic gates
- Flashing lights
- Warning electronic bells
- Crossbucks
- Power-out indicators

Grade Crossing Safety Deficiencies

There are no raised medians, and the roadway is not wide enough to implement a non-traversable curb to prevent motorists from driving around a lowered gate. Stop lines are not present before each gate on either grade crossing approach.

Grade Crossing Safety Recommendations

In order for this grade crossing to be part of a future quiet zone, the following supplementary safety measures (SSM) are recommended:

- Install 100 feet of channelization devices from the gate arm on southbound approach
- Install 90 feet of channelization devices from the gate arm on the northbound approach
- Install RR pavement markings on both grade crossing approaches
- Install stop lines on both grade crossing approaches
- At the time of the grade crossing inspection, pedestrians were observed crossing the railroad track. As a long-term grade crossing safety improvement, it is recommended that pedestrian facilities be provided.

- Ensure gate arm length is within one foot of the roadway centerline
- As a long-term grade crossing improvement, it is recommended that pedestrian facilities be provided.

Estimate of Probable Construction Cost

The table below summarizes the estimated construction cost of the above recommended safety improvements.

Helmets St (DOT# 287967S)	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Cost</u>
Construction Cost Subtotal	-	-	-	\$ 23,804
Mobilization (15%)	1	LS	\$ 3,571.00	\$ 3,571.00
Construction Railroad Flagging	2	DAY	\$ 1,500.00	\$ 3,000.00
Contingency (10%)	1	LS	\$ 2,380.00	\$ 2,380.00
Railroad Protective Liability Insurance	1	EA	\$ 1,500.00	\$ 1,500.00
Railroad's Cost to Administer Quiet Zone	1	EA	\$ 10,000.00	\$ 10,000.00
Engineering Cost (12%)	1	LS	\$ 2,856.00	\$ 2,856.00
Total Estimated Project Cost				\$ 47,111.00

A more detailed cost estimate is provided in **Appendix A**.

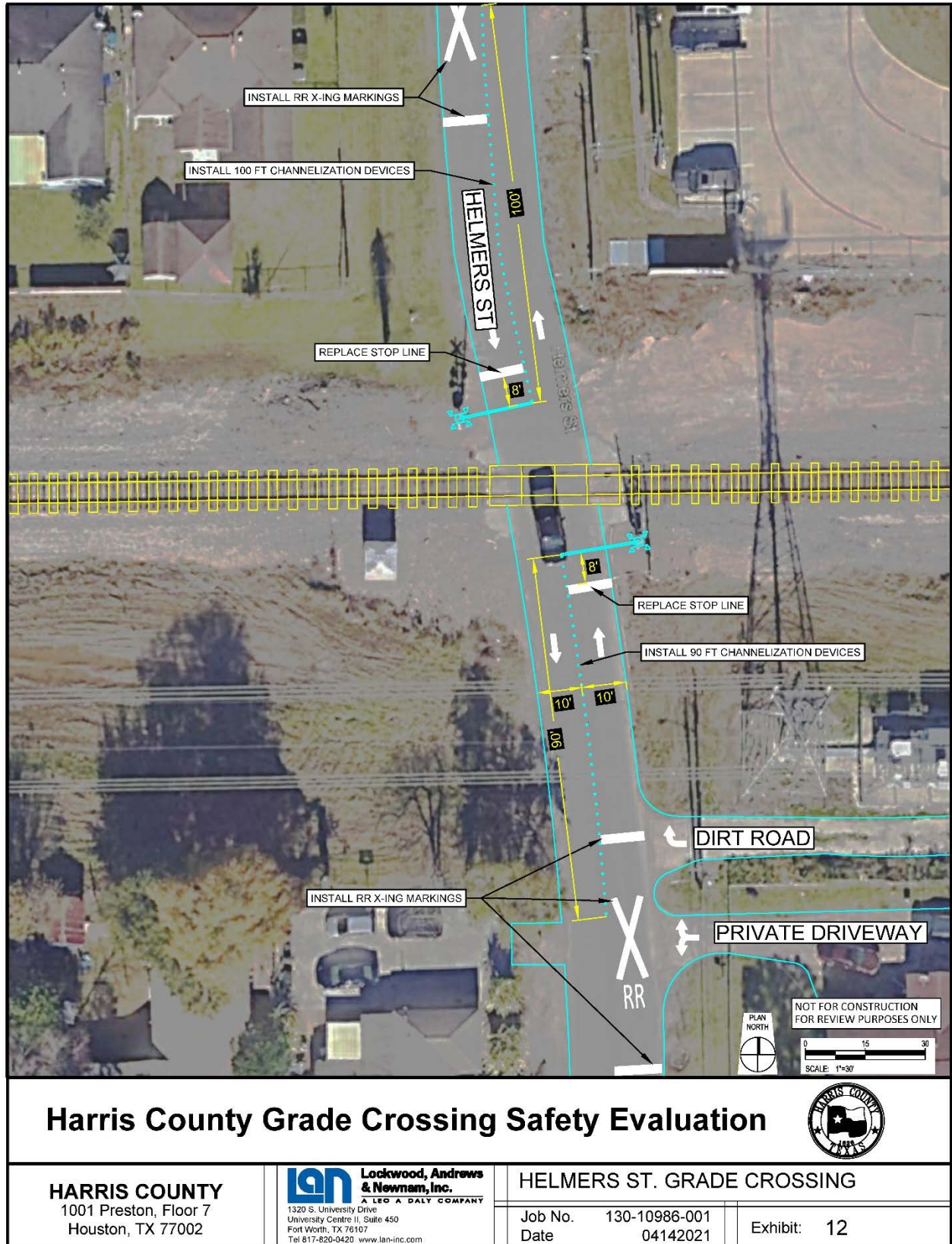


Figure 12. SSM for the Grade Crossing at Helmers Street

BNSF Grade Crossing DOT# 287968Y at Irvington Boulevard

Existing Grade Crossing Conditions

Irvington Boulevard is a 4-lane, divided roadway that runs in a north to south direction without intersecting any local streets within 100 feet. Pedestrian facilities are available on both sides of Irvington Boulevard. A 5-foot bike lane is found on each approach. The approach grades to the grade crossing are approximately 5% and 3% for the northbound and southbound approaches, respectively. The posted speed limit is 35 mph. The following signs and pavement markings were found on Irvington Boulevard near the grade crossing:

- W10-1 signs on both grade crossing approaches
- RR Xing pavement markings on both grade crossing approaches
- Faded stop lines on both grade crossing approaches



Figure 13. Grade Crossing at Irvington Boulevard (Northbound Approach)

Figures 13 and 14 also show the recently installed emergency signal for the Houston Fire Station 30 just south of the Irvington grade crossing. In the event that the emergency-vehicle traffic control signal is activated to stop traffic, the southbound queue may extend beyond the railroad track. s



Figure 14. Grade Crossing at Irvington Boulevard (Southbound Approach)

It is noted that LAN did not have access to the railroad bungalow to analyze the existing train detection equipment and track design plans; however, the following active grade crossing equipment is available or visible from the public right-of-way:

- Automatic gates
- Flashing lights
- Warning electronic bells
- Crossbucks
- Power-out indicators

Grade Crossing Safety Deficiencies

The top of the existing medians drops to the same elevation as the roadway near the railroad track and cannot prevent motorists from driving around a lowered gate. **Figure 15** shows the existing raised medians.

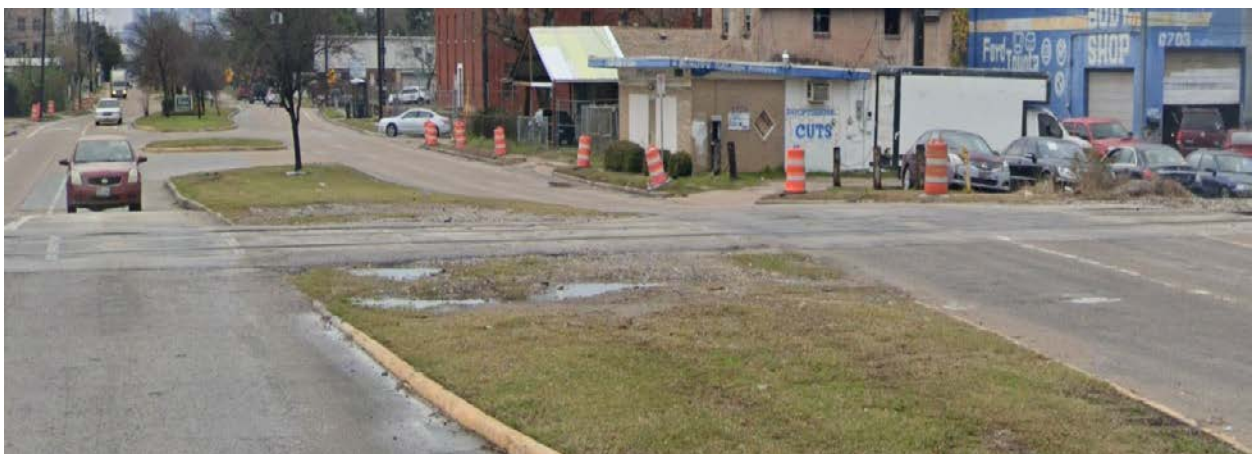


Figure 15. Existing Raised Medians at the Irvington Boulevard Grade Crossing

Figures 16 and 17 show that the existing sidewalks are not continuous over the railroad track.



Figure 16. Discontinuous Sidewalk Adjacent to Southbound Approach



Figure 17. Discontinuous Sidewalk Adjacent to Northbound Approach

Grade Crossing Safety Recommendations

In order for this grade crossing to be part of a future quiet zone, the following supplementary safety measures (SSM) are recommended:

- Install additional crossing panels to connect sidewalks across the railroad track as shown in **Figure 18** below.
- Close median opening on southbound grade crossing approach near the track and install 6" curb to prevent motorists from driving around a lowered gate.
- Install 6" curb to prevent motorists from driving around a lowered gate on northbound grade crossing approach.
- Replace faded RR pavement markings on both grade crossing approaches
- Replace faded RR pavement markings on both bike lanes
- Replace faded stop lines on both grade crossing approaches
- Install a DO NOT STOP ON TRACKS sign (R8-8) on the southbound grade crossing approach to warn motorists not to queue over the track in the event that the emergency signal is activated to stop traffic for the Houston Fire Station 30.
- Ensure gate arm length is within one foot of the raised median
- Install LOOK signs (R15-8) in the immediate vicinity of the grade crossing

In the future, consideration may be given to installing automatic pedestrian gates and emergency exit gates at each sidewalk crossing.

Estimate of Probable Construction Cost

The table below summarizes the estimated construction cost of the above recommended safety improvements.

Irvington Blvd (DOT# 287968Y)	Quantity	Unit	Unit Cost	Cost
Construction Cost Subtotal	-	-	-	\$ 127,814
Mobilization (15%)	1	LS	\$19,172.00	\$ 19,172.00
Construction Railroad Flagging	2	DAY	\$ 1,500.00	\$ 3,000.00
Contingency (10%)	1	LS	\$12,781.00	\$ 12,781.00
Railroad Protective Liability Insurance	1	EA	\$ 1,500.00	\$ 1,500.00
Railroad's Cost to Administer Quiet Zone	1	EA	\$10,000.00	\$ 10,000.00
Engineering Cost (12%)	1	LS	\$15,338.00	\$ 15,338.00
Total Estimated Project Cost				\$ 189,605.00

A more detailed cost estimate is provided in **Appendix A**.

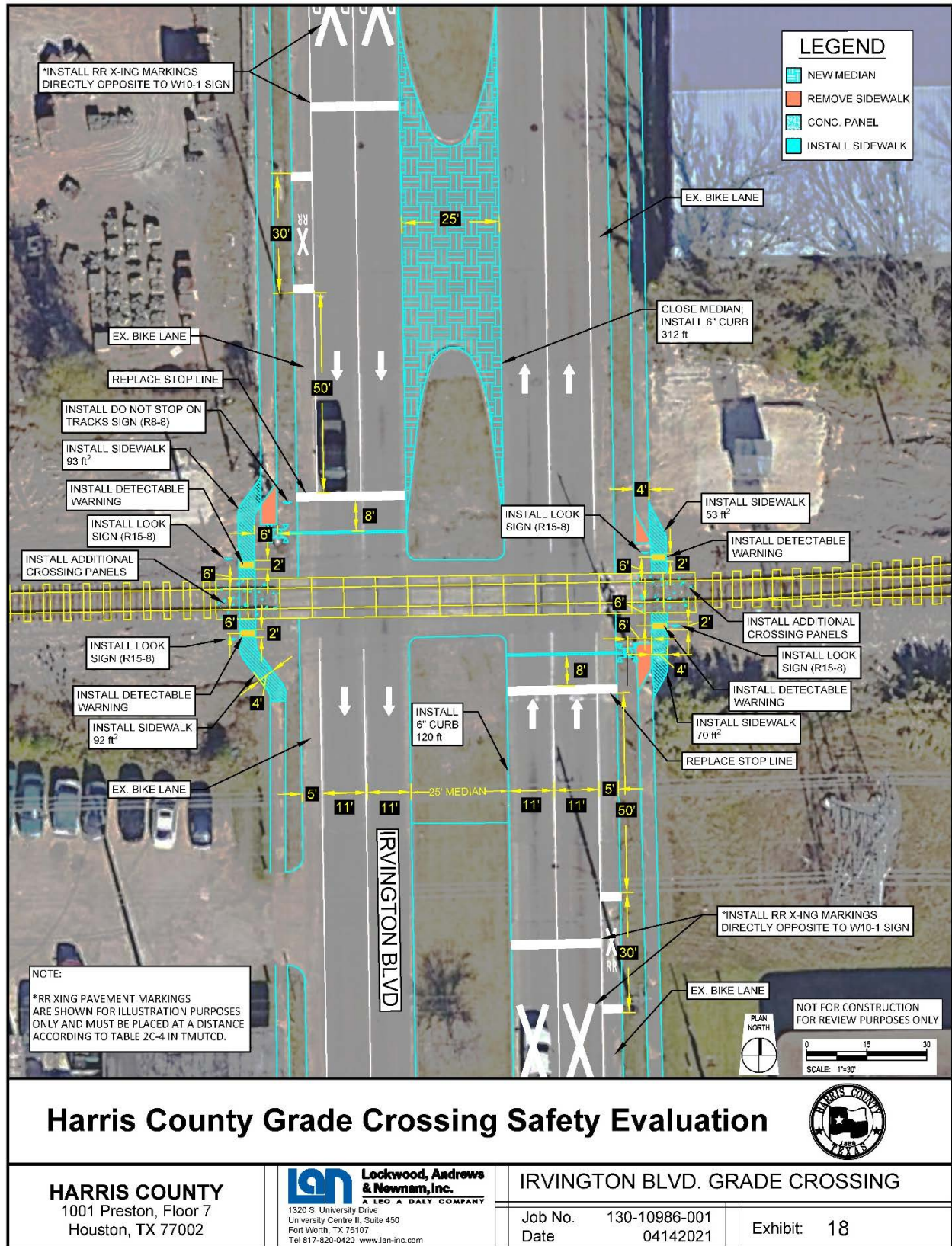


Figure 18. SSMs for Grade Crossing at Irvington Boulevard

UPRR Grade Crossing DOT# 287969Y at W. Hardy Street

Existing Grade Crossing Conditions

W. Hardy Street is a 4-lane, divided roadway that runs in a north to south direction without intersecting any streets within 100 feet. Pedestrian facilities are not available on either side of W. Hardy Road. The approach grades to the grade crossing are approximately 3% on each approach. The posted speed limit is 40 mph. The following signs and pavement markings were found on W. Hardy Street near the grade crossing:

- No W10-1 signs on either grade crossing approach
- No RR Xing pavement markings on either grade crossing approach
- No stop lines on both grade crossing approaches



Figure 19. Grade Crossing at W. Hardy Street (Southbound Approach)



Figure 20. Grade Crossing at W. Hardy Street (Northbound Approach)

It is noted that LAN did not have access to the railroad bungalow to analyze the existing train detection equipment and track design plans; however, the following active grade crossing equipment is available or visible from the public right-of-way:

- Automatic gates
- Flashing lights
- Warning electronic bells
- Crossbucks
- Power-out indicators

Grade Crossing Safety Deficiencies

The following grade crossing safety deficiencies were noted at the time of inspection:

- Stop lines are missing on each grade crossing approach
- No grade crossing advance warning (W10-1) signs on either approach
- No RR Xing pavement markings on either approach

Grade Crossing Safety Recommendations

The existing 2-foot wide raised median already prevents motorists from driving around a lowered gate during simultaneous preemption. The following supplementary safety measures (SSM) are also recommended at this location:

- Install RR pavement markings on both grade crossing approaches
- Install stop lines on both grade crossing approaches
- Install grade crossing advance warning sign (W10-1) on each grade crossing approach
- Ensure gate arm length is within one foot of the raised median
- Replace existing raised median with 2-ft raised median with 8" curb height on both approaches to accommodate future roadway overlay

Estimate of Probable Construction Cost

The table below summarizes the estimated construction cost of the above recommended safety improvements.

Hardy St (DOT# 287969F)	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Cost</u>
Construction Cost Subtotal	-	-	-	\$ 12,664.00
Mobilization (15%)	1	LS	\$ 1,900.00	\$ 1,900.00
Construction Railroad Flagging	2	DAY	\$ 1,500.00	\$ 3,000.00
Contingency (10%)	1	LS	\$ 1,266.00	\$ 1,266.00
Railroad Protective Liability Insurance	1	EA	\$ 1,500.00	\$ 1,500.00
Railroad's Cost to Administer Quiet Zone	1	EA	\$10,000.00	\$ 10,000.00
Engineering Cost (12%)	1	LS	\$ 1,520.00	\$ 1,520.00
Total Estimated Project Cost				\$ 31,850.00

A more detailed cost estimate is provided in **Appendix A**.

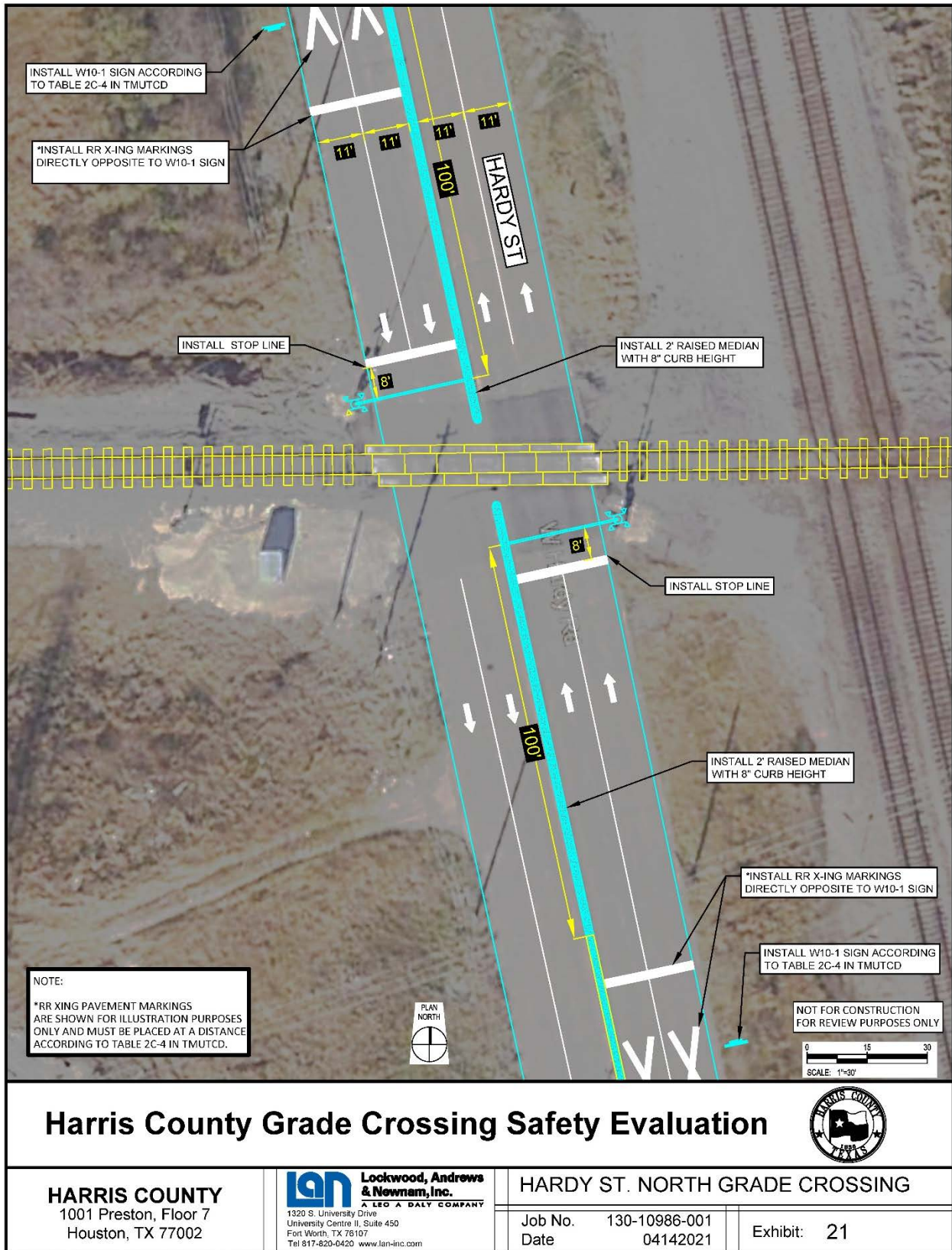


Figure 21. SSM for Grade Crossing at W. Hardy Street

UPRR Grade Crossing DOT# 287970A at W. Hardy Street

Existing Grade Crossing Conditions

W. Hardy Street is a 4-lane, divided roadway that runs in a north to south direction without intersecting any local streets within 100 feet. Pedestrian facilities are not available on either side of W. Hardy Road. The approach grades to the grade crossing are approximately 3% on each approach. The posted speed limit is 40 mph. The following signs and pavement markings were found on W. Hardy Street near the grade crossing:

- No W10-1 signs on either grade crossing approach
- No RR Xing pavement markings on either grade crossing approach
- No stop lines on both grade crossing approaches



Figure 22. Grade Crossing at W. Hardy Street (Southbound Approach)



Figure 23. Grade Crossing at W. Hardy Street (Northbound Approach)

It is noted that LAN did not have access to the railroad bungalow to analyze the existing train detection equipment and track design plans; however, the following active grade crossing equipment is available or visible from the public right-of-way:

- Automatic gates
- Flashing lights
- Warning electronic bells
- Crossbucks
- Power-out indicators

This track connects the BNSF Railway Belt Junction Line to the Union Pacific (UPRR) Houston East Belt Subdivision.

Grade Crossing Safety Deficiencies

The following grade crossing safety deficiencies were noted at the time of inspection:

- Stop lines are missing on each grade crossing approach
- No grade crossing advance warning (W10-1) signs on either approach
- No RR Xing pavement markings on either approach

Grade Crossing Safety Recommendations

The existing 2-foot wide raised median already prevents motorists from driving around a lowered gate during simultaneous preemption. The following supplementary safety measures (SSM) are also recommended at this location:

- Install RR pavement markings on both grade crossing approaches
- Install stop lines on both grade crossing approaches
- Install grade crossing advance warning sign (W10-1) on each grade crossing approach
- Ensure gate arm length is within one foot of the raised median
- Replace existing raised median with 2-ft raised median with 8" curb height on both approaches to accommodate future roadway overlay

Estimate of Probable Construction Cost

The table below summarizes the estimated construction cost of the above recommended safety improvements.

Hardy St (DOT# 287970A)	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Cost</u>
Construction Cost Subtotal	-	-	-	\$ 19,088
Mobilization (15%)	1	LS	\$ 2,863.00	\$ 2,863.00
Construction Railroad Flagging	2	DAY	\$ 1,500.00	\$ 3,000.00
Contingency (10%)	1	LS	\$ 1,909.00	\$ 1,909.00
Railroad Protective Liability Insurance	1	EA	\$ 1,500.00	\$ 1,500.00
Railroad's Cost to Administer Quiet Zone	1	EA	\$10,000.00	\$ 10,000.00
Engineering Cost (12%)	1	LS	\$ 2,291.00	\$ 2,291.00
Total Estimated Project Cost				\$ 40,651.00

A more detailed cost estimate is provided in **Appendix A**.

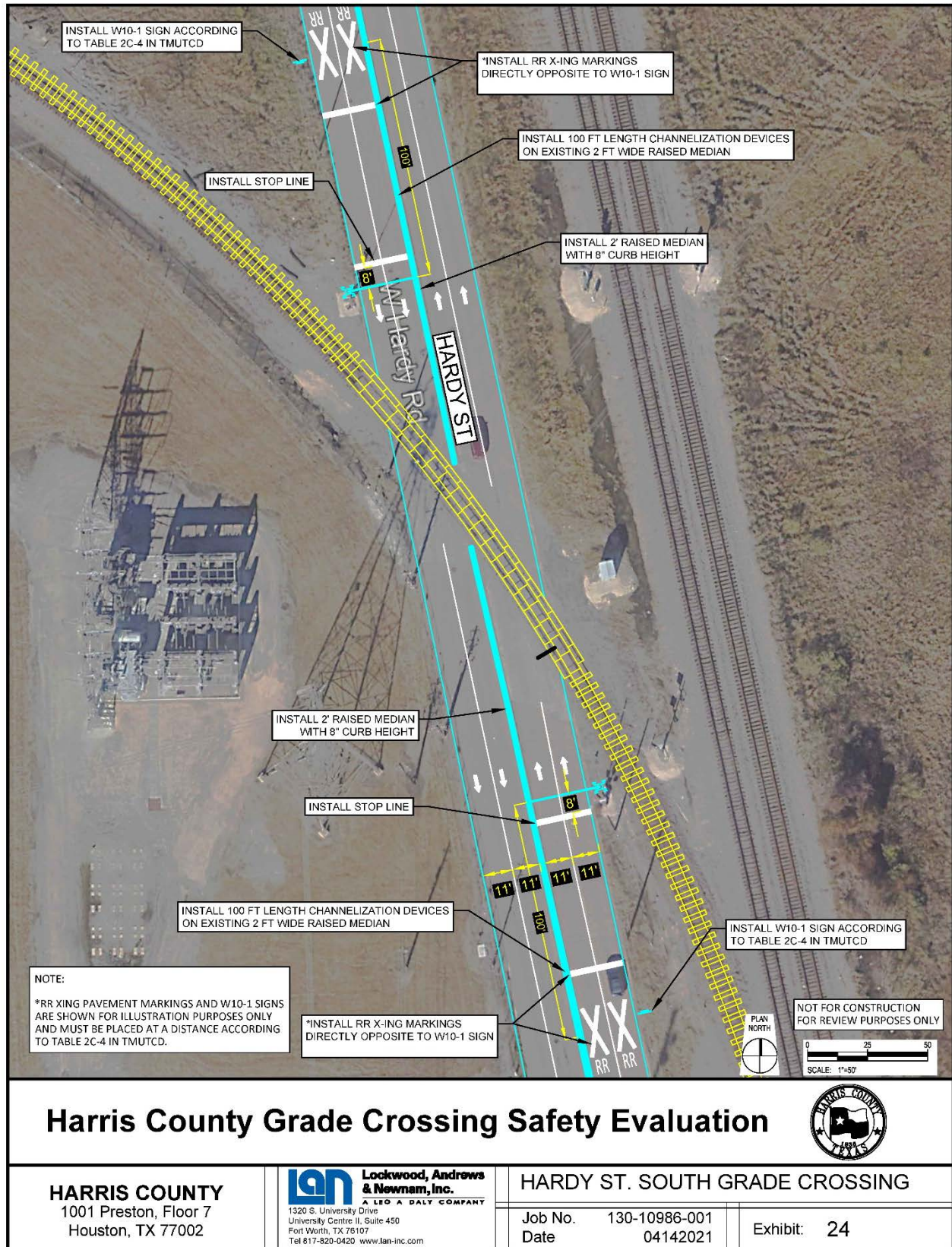


Figure 24. SSM for Grade Crossing at W. Hardy Street

Findings and Recommendations

During the safety evaluation of each grade crossing, several safety deficiencies were identified. It is noted that the safe deficiencies are based on the FRA's requirements for the establishment of a quiet zone, the Texas Manual on Uniform Traffic Control Devices (TMUTCD) standards for grade crossings, the FRA Highway-Rail Grade Crossing Handbook (3rd Edition), PROWAG requirements for sidewalk as well as TxDOT's railroad crossing signing, striping, and device placement standards.

BNSF Grade Crossing DOT# 287965D at Fulton Street

Grade Crossing Safety Deficiencies:

- Existing medians are not long enough to meet FRA's quiet zone requirements
- Gate for the southbound approach encroaches in the sidewalk and does not allow the minimum 4-ft clear width around obstructions required by PROWAG.

Grade Crossing Safety Recommendations:

- Extend existing raised median to at least 60 feet from the gate on each approach
- Realignment of Stokes Street is required on the northbound approach to allow the existing raised median to be extended
- Replace faded grade crossing pavement markings
- Reroute sidewalk adjacent to southbound approach

BNSF Grade Crossing DOT# 287966K at Donlen Street

Grade Crossing Safety Deficiencies:

- No RR Xing pavement markings on either approach
- No grade crossing advance warning sign (W10-4) on Frisco Street

Grade Crossing Safety Recommendations:

- Install channelization devices for a length of at least 60 feet on each approach
- Two options are proposed for installing channelization devices on the northbound approach. Roswell Street may be closed or operate as right-in right-out for channelization devices to be installed.
- Install grade crossing pavement markings on both approaches
- Install W10-4 sign on Frisco Street

BNSF Grade Crossing DOT# 287967S at Helmers Street

Grade Crossing Safety Deficiencies:

- No grade crossing advance signs (W10-1) on either approach
- No RR Xing pavement markings on either approach

Grade Crossing Safety Recommendations:

- Install channelization devices for a length of 100 feet on southbound approach and 90 feet on the northbound approach
- Install RR Xing pavement markings on both approaches
- Replace faded grade crossing pavement markings

BNSF Grade Crossing DOT# 287968Y at Irvington Boulevard

Grade Crossing Safety Deficiencies:

- Sidewalks are not continuous across the railroad track on both approaches
- Existing median cannot prevent motorists from driving around lowered gates

Grade Crossing Safety Recommendations:

- Install additional crossing panels to connect sidewalks across the railroad track
- Install 6" curb on medians on both approaches to prevent motorists from driving around lowered gates.
- Close median opening on southbound approach
- Replace faded grade crossing pavement markings on both approaches and existing bike lanes

UPRR Grade Crossing DOT# 287969F at W. Hardy Street

Grade Crossing Safety Deficiencies:

- No grade crossing advance signs (W10-1) on either approach
- No RR Xing pavement markings on either approach
- No stop lines before gate on either approach

Grade Crossing Safety Recommendations:

- Replace existing raised median with 2-ft raised median with 8" curb height on both approaches
- Install grade crossing pavement markings on both approaches
- Install grade crossing advance signs (W10-1) on both approach
- Ensure gate arm length is within one foot of the raised median

UPRR Grade Crossing DOT# 287970A at W. Hardy Street

Grade Crossing Safety Deficiencies:

- No grade crossing advance signs (W10-1) on either approach
- No RR Xing pavement markings on either approach
- No stop lines before gate on either approach

Grade Crossing Safety Recommendations:

- Replace existing raised median with 2-ft raised median with 8" curb height on both approaches
- Install grade crossing pavement markings on both approaches
- Install grade crossing advance signs (W10-1) on both approach
- Ensure gate arm length is within one foot of the raised median

A list of private driveways that are impacted by the recommended grade crossing safety improvements is found in **Appendix A**.

Opinion of Probable Construction Costs

Based on the safety improvements recommended at each grade crossing in the study corridor, an estimate of probable construction cost was calculated based on LAN's experience with prior projects and TxDOT's 12-month statewide average low bid unit prices. **Appendix B** provides an itemized estimate of probable construction cost for each of the grade crossing evaluated.

Appendix C provides an example of a grade crossing continuous curbing and channelizing system that may be installed at the grade crossings at Donlen Street and Hemlers Street. It is noted that the city of Houston has installed these channelizing devices in several existing quiet zones.

Appendix A – Driveway Impact Summary

Crossing Street	DOT#	Approach Direction	Driveway Type	Driveway Width (ft)	Distance From Gate (ft)	Driveway Along Bus Route?	Traffic Channelizing Devices	Impacted Driveway	Driveway Impact	Estimated Daily Trips
Fulton Street	287965D (BNSF)	Side Street approach on Stokes Street	Commercial	19	218	No	100' Raised Median	Drop-off/pick-up driveway off Stokes Street for Roosevelt Elementary	Realignment of Stokes Street will shorten the drop-off/pick-up curb length, but will not impact the width of the street	130
Donlen Street	287966K (BNSF)	Southbound approach on Donlen Street	Residential	11	75	No	100' Traversable Raised Curb with Delineators	Private driveway to 6803 Donlen Street	The private driveway will be restricted to right-in right-out access	10
Helmers Street	287967S (BNSF)	Northbound approach on Helmers Street	Residential	15	70	No	90' Traversable Raised Curb with Delineators	Private driveway to communication equipment	The private driveway will be restricted to right-in right-out access	<1
Irvington Boulevard	287968Y (BNSF)	None	NA	-	-	-	-	No driveway impact	No driveway impact	0
Hardy Street	287969F (UPRR)	None	NA	-	-	-	-	No driveway impact	No driveway impact	0
Hardy Street	287970A (UPRR)	None	NA	-	-	-	-	No driveway impact	No driveway impact	0

Appendix B – Opinion of Probable Construction Costs

Crossing	Description	Quantity	Unit	Unit Cost	Cost
Fulton St 287965D (BNSF)	Add Concrete Curb and Gutter	233	LF	\$ 30.00	\$ 6,990.00
	Remove Concrete	156	CY	\$ 185.00	\$ 28,860.00
	Remove Curb and Gutter	583	LF	\$ 5.00	\$ 2,915.00
	Install 6" Curb and Gutter	452	LF	\$ 30.00	\$ 13,560.00
	Paved Concrete (reinforced)	1183	SY	\$ 75.00	\$ 88,725.00
	Install Small Sign & Support Assembly	4	EA	\$ 560.00	\$ 2,240.00
	Detectable Warning Strips	4	EA	\$ 630.00	\$ 2,520.00
	Relocate Trees	12	EA	\$ 500.00	\$ 6,000.00
	Remove Concrete Sidewalk	178	SY	\$ 15.00	\$ 2,670.00
	Concrete Median	57	SY	\$ 84.00	\$ 4,788.00
	Concrete Sidewalk	172	SY	\$ 70.00	\$ 12,040.00
	Furnish and Place Topsoil (6")	780	SY	\$ 3.00	\$ 2,340.00
	Widen Railroad Crossing Panels	8	LF	\$ 2,000.00	\$ 16,000.00
	Eliminate Existing RR Pavement Markings	3	EA	\$ 400.00	\$ 1,200.00
	Eliminate Existing Pavement Markings (24")	96	LF	\$ 4.00	\$ 384.00
	Pavement Marking RR Symbol W (SLD)	3	EA	\$ 450.00	\$ 1,350.00
	Pavement Marking 24" W (SLD)	96	LF	\$ 8.00	\$ 768.00
	Temporary Traffic Control	30	EA	\$ 650.00	\$ 19,500.00
	Fulton Street Grade Crossing Subtotal				\$ 212,850.00
Donlen St 287966K (BNSF)	100 ft of channelizing devices on SB approach and 60 ft on NB approach	160	LF	\$ 110.00	\$ 17,600.00
	Pavement Marking 24" W (SLD)	60	LF	\$ 8.00	\$ 480.00
	Temporary Traffic Control	2	EA	\$ 650.00	\$ 1,300.00
	Pavement Marking RR Symbol W (SLD)	2	EA	\$ 450.00	\$ 900.00
	Install Small Sign & Support Assembly	1	EA	\$ 560.00	\$ 560.00
	Remove asphalt	47	SY	\$ 13.00	\$ 611.00
	Donlen Street Grade Crossing Subtotal				\$ 21,451.00
Helmets St 287967S (BNSF)	100 ft of channelizing devices on SB approach and 90 ft on NB approach	190	LF	\$ 110.00	\$ 20,900.00
	Temporary Traffic Control	2	EA	\$ 650.00	\$ 1,300.00
	Pavement Marking 24" W (SLD)	88	LF	\$ 8.00	\$ 704.00
	Pavement Marking RR Symbol W (SLD)	2	EA	\$ 450.00	\$ 900.00
	Helmets Street Grade Crossing Subtotal				\$ 23,804.00
Irvington Blvd 287968Y (BNSF)	Remove Concrete	39	CY	\$ 185.00	\$ 7,215.00
	Furnish and Place Topsoil (6")	194	SY	\$ 3.00	\$ 582.00
	Remove Concrete Sidewalk	83	SY	\$ 15.00	\$ 1,245.00
	Install Small Sign & Support Assembly	5	EA	\$ 560.00	\$ 2,800.00
	Concrete Sidewalk	308	SY	\$ 70.00	\$ 21,560.00
	Temporary Traffic Control	15	EA	\$ 500.00	\$ 7,500.00
	Install 6" Curb and Gutter	432	LF	\$ 30.00	\$ 12,960.00
	Furnish and Place Topsoil (6")	320	SY	\$ 3.00	\$ 960.00
	Pavement Marking RR Symbol W (SLD)	4	EA	\$ 450.00	\$ 1,800.00
	Detectable Warning Strips	4	EA	\$ 630.00	\$ 2,520.00
	Widen Railroad Crossing Panels	32	LF	\$ 2,000.00	\$ 64,000.00
	Eliminate Existing RR Pavement Markings	4	EA	\$ 400.00	\$ 1,600.00
	Eliminate Existing Pavement Markings (24")	156	LF	\$ 4.00	\$ 624.00
	Eliminate Existing Pavement Markings (Bike RR Xing)	2	EA	\$ 50.00	\$ 100.00
	Pavement Marking RR Symbol (Bike RR Xing)	2	EA	\$ 550.00	\$ 1,100.00
	Pavement Marking 24" W (SLD)	156	LF	\$ 8.00	\$ 1,248.00
	Irvington Boulevard Grade Crossing Subtotal				\$ 127,814.00
Hardy St 287969F (UPRR)	Temporary Traffic Control	2	EA	\$ 650.00	\$ 1,300.00
	Pavement Marking 24" W (SLD)	138	LF	\$ 8.00	\$ 1,104.00
	Install Small Sign & Support Assembly	2	EA	\$ 560.00	\$ 1,120.00
	Removing Concrete Median	50	SY	\$ 16.00	\$ 800.00
	Install Concrete Median (8")	50	SY	\$ 130.00	\$ 6,500.00
	Install Concrete Median Nose	0.5	SY	\$ 80.00	\$ 40.00
	Pavement Marking RR Symbol W (SLD)	4	EA	\$ 450.00	\$ 1,800.00
	Hardy Street Grade Crossing Subtotal				\$ 12,664.00
Hardy St 287970A (UPRR)	Temporary Traffic Control	2	EA	\$ 650.00	\$ 1,300.00
	Pavement Marking 24" W (SLD)	138	LF	\$ 8.00	\$ 1,104.00
	Install Small Sign & Support Assembly	2	EA	\$ 560.00	\$ 1,120.00
	Removing Concrete Median	94	SY	\$ 16.00	\$ 1,504.00
	Install Concrete Median (8")	94	SY	\$ 130.00	\$ 12,220.00
	Install Concrete Median Nose	0.5	SY	\$ 80.00	\$ 40.00
	Pavement Marking RR Symbol W (SLD)	4	EA	\$ 450.00	\$ 1,800.00
	Hardy Street Grade Crossing Subtotal				\$ 19,088.00
Subtotal					\$ 417,671.00
Mobilization (15%)		1	LS	\$ 62,651.00	\$ 62,651.00
Construction Railroad Flagging		12	DAY	\$ 1,500.00	\$ 18,000.00
Contingency (10%)		1	LS	\$ 41,767.00	\$ 41,767.00
Railroad Protective Liability Insurance		6	EA	\$ 1,500.00	\$ 9,000.00
Railroad's Cost to Administer Quiet Zone		6	EA	\$ 10,000.00	\$ 60,000.00
Total Probable Construction Cost					\$ 609,089.00
Engineering Cost (12%)		1	LS	\$ 50,121.00	\$ 50,121.00
Total Estimated Project Cost					\$ 659,210.00

Appendix C – Grade Crossing Traffic Channelizing Devices



Figure 1. Qwick Kurb Channelizing System



Figure 2. Water Works Blvd, Houston, TX

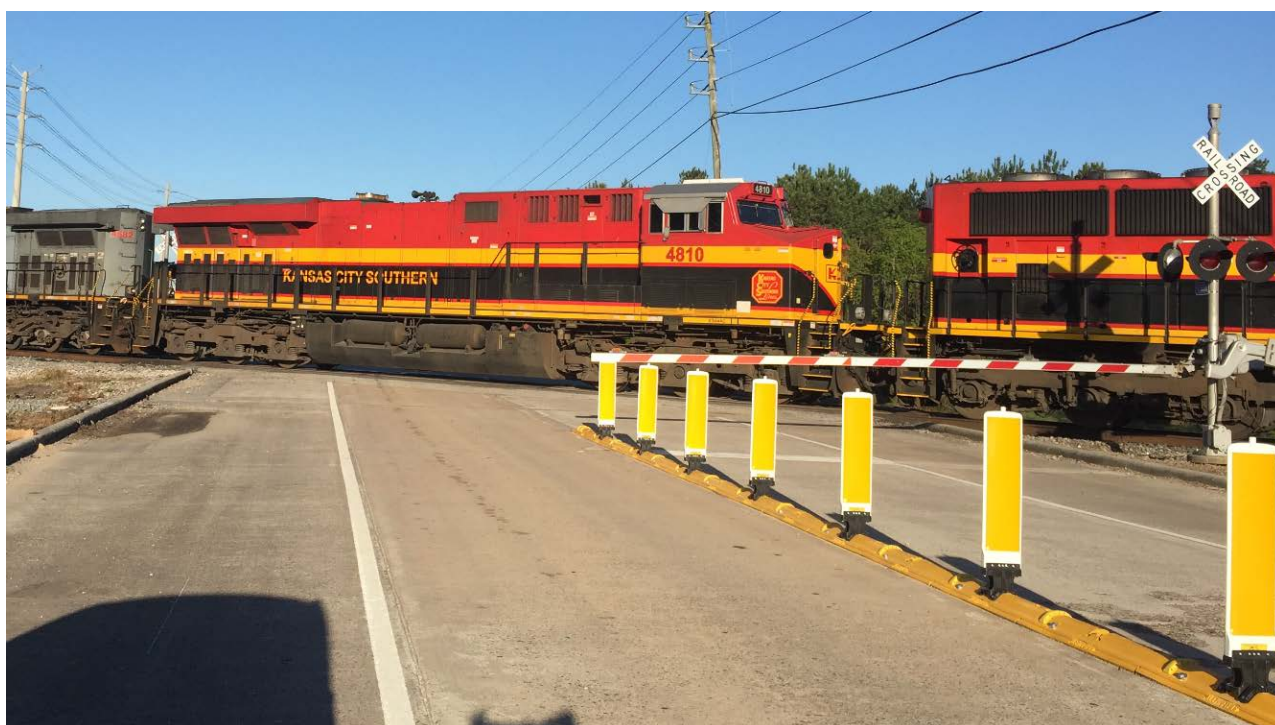


Figure 3. Water Works Blvd, Houston, TX