J4S3374
Prospect over I-70
Jackson County, MO

CONCEPTUAL ALTERNATIVES MEMORANDUM

Approved by: Chris Redline Digitally signed by Chris Redline Date: 2022.02.01 09:19:37 -06'00'

(MoDOT District Engineer)

Date: _____

1.0 Project Overview

The Prospect Avenue bridge over I-70 is located to the east of the US-71 and I-70 interchange in Kansas City, Missouri. The Missouri Department of Transportation (MoDOT) has completed numerous bridge improvement projects in recent history along the I-70 corridor, including the Chestnut Avenue bridge, to upgrade aging infrastructure, increase the vertical clearance, and to accommodate future I-70 improvements. The main objective of this project is to replace the Prospect Avenue bridge due to its aging condition and a substandard vertical clearance height of 14'-9". Different alternatives were evaluated to improve the traffic and operations of the Prospect Avenue corridor.

In addition to the substandard clearance, some of the existing challenges to evaluate include the close proximity to existing businesses north and south of the bridge, Chestnut Avenue bridge over I-70, and an existing retaining wall along the I-70 EB on-ramp. Existing frontage roads also merge with three of the four ramps. Proposed improvements include separating the I-70 EB on and off ramps from 14th Street.

The Prospect Avenue and I-70 project limits are from Truman Road south of I-70 to 12th Street north of I-70 in Jackson County (see **Figure 1** below) and includes all four ramps adjacent to Prospect Avenue.

Figure 1 – Prospect Ave. Concept Study Location

1.1 Project Purpose and Goals

Several bridge and interchange improvements to the I-70 corridor in Kansas City, Missouri have been made over the last 15 years by MoDOT. These improvements resulted from increased traffic demand and in preparation for corridor improvements as identified in a Second Tier Environmental Impact Statement (STEIS) record of decision (ROD) in 2018. One of the programmatic improvements that have been implemented through the corridor is the replacement and lengthening of cross road bridges over I-70 to make way for future corridor

widening or other spot improvements. The purpose of this study is to evaluate what types of interchange and ramp improvements are needed in coordination with the Prospect Avenue bridge replacement to provide a safe and efficient transportation corridor for current and future conditions. To accomplish the study purpose, the following prioritized study goals were developed by the study team in conjunction with the project's Core Team members.

1. Replace the structure economically - increase vertical clearance
2. Maintenance of traffic (I-70 and Prospect Avenue) during construction
3. Coordination with the I-70 Corridor project
4. Minimize Right of Way impacts
5. Improve safety and operations of Prospect Avenue with I-70 and local roads
6. Accommodation of KCMO long-term corridor plans
7. Pedestrian and non-motorized users' accommodations
8. Obtain stakeholder support for the project

1.2 Existing Conditions

The evaluation of existing conditions for the Prospect Avenue/I-70 corridor was divided into bridge, roadway, and drainage categories.

1.2.1 Bridge

- **Prospect Avenue over I-70**: The existing bridge (A0291) was constructed in 1958 and is composed of four continuous concrete box girder spans (52'-75'-75'-52'). Sidewalk overhangs were added in 1960. It is 60'-0" wide (out-to-out) and 258'-11" in length (fill face to fill face). The vertical clearance over I-70 is 14'-9" which is less than the desired clearance of 16'-6". There are less than desirable pedestrian accommodations on the bridge.

1.2.2 Roadway

- **Prospect Avenue**: Prospect Avenue has a posted speed limit of 35 mph and currently has four travel lanes. The lanes are 10' wide with no shoulders. There are two existing sidewalks, one on each side of the bridge. Both I-70 entrance ramps and the I-70 WB exit ramp have undesirable grades. Existing frontage roads merge into and from three of the four existing entrance and exit ramps. South of I-70, 14th Street will be separated from the I-70 EB on and off ramps to improve safety. Based on Core Team discussion, any proposed improvements should not interfere with the existing Chestnut Avenue bridge or the retaining wall along the ramp from Prospect Avenue to eastbound I-70.

- **I-70 Mainline:** The current I-70 westbound direction has four through lanes, a 7' inside shoulder, and a 10' outside shoulder. The current I-70 eastbound direction has three through lanes, a 7' inside shoulder, and a 20' outside shoulder. The 2020 AADT for this corridor on I-70 is almost 50,000 in each direction and consists of approximately 37% truck traffic.

1.2.3 Drainage

The existing drainage for this project was constructed in the early 1960's. The condition of the 60-year-old existing pipes is not known. The life of most pipe is typically 70 to 100 years. The original as-builts do not indicate the pipe class, however subsequent plans show Class III RCP. The hydraulic adequacy of these existing drainage systems is not known.

It is recommended that the condition of the existing pipes be assessed, especially in areas where they are to be left in place within the construction limits of the proposed project. Having MoDOT maintenance feedback on known issues is recommended, along with an inspection in accordance with Specification 724.3, before the selected interchange design. Alternately, MoDOT may decide to replace the pipes under new alignments outright. Replacements are likely to be challenging, costly, and affect traffic control significantly.

1.3 Concurrent Project Design & Coordination

The project approach and proposed work for the Prospect Avenue bridge project will be coordinated with the I-70 Corridor Project team. Coordinated work includes the future I-70 typical section at Prospect Avenue and any Prospect Avenue ramp impacts to the I-70 corridor. Operational analysis, traffic counts, accident information, and any other relevant information for Prospect Avenue will be shared with the I-70 corridor team upon completion.

1.4 Future Conditions

The current Prospect Avenue bridge cannot accommodate the future I-70 improvements within the "Fix Key Bottlenecks" strategy identified in the I-70 STEIS. The I-70 STEIS preferred alternative includes four westbound lanes and three eastbound lanes under Prospect Avenue. However, the ongoing I-70 corridor study is investigating the possibility of additional through lanes for portions of the I-70 corridor. For the Prospect Avenue Concept Study, additional pavement is shown so that a future I-70 expansion can be accommodated. An assumed future I-70 typical section seen in **Figure 2** was used during the bridge and interchange alternatives development and evaluation.

1.5 Proposed Conditions

A proposed I-70 typical section can be seen in **Figure 3** with retaining walls located such that the assumed future I-70 typical can be accommodated. Improvements to I-70 include Type C median barrier and inside shoulder pavement replacement for bridge pier protection. Pending results of the ongoing traffic modeling and analysis of the potential project improvement, the proposed Prospect Avenue typical section could either be a four-lane or three-lane section. As the four-lane section is the most conservative, it was selected for the concept study analysis. A proposed four-lane Prospect Avenue typical section can be seen in **Figure 4** and a three-lane typical section can be seen in **Figure 5**.

Figure 2 – I-70 Assumed Future Typical Section

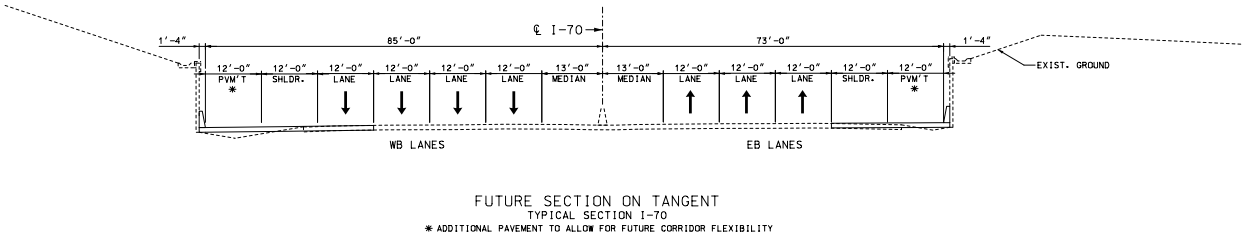


Figure 3 – I-70 Proposed Typical Section

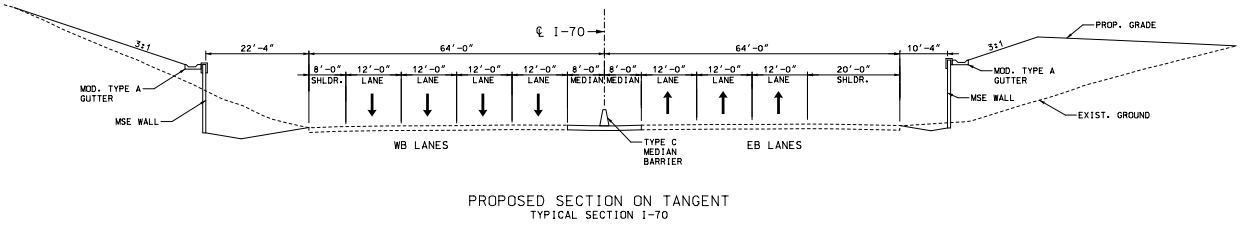


Figure 4 – Prospect Avenue Proposed 4-Lane Typical Section

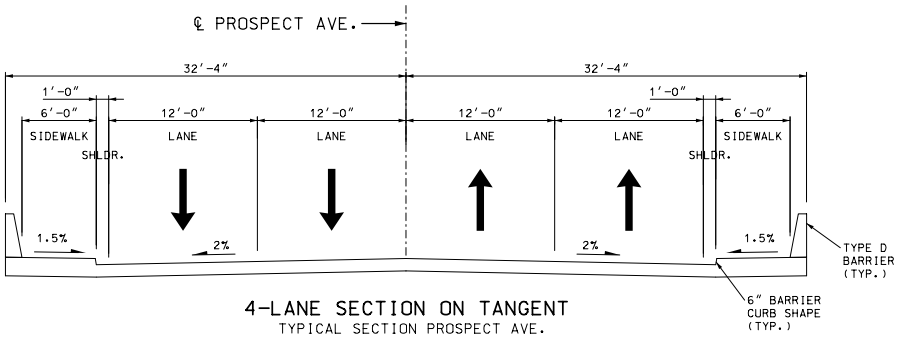
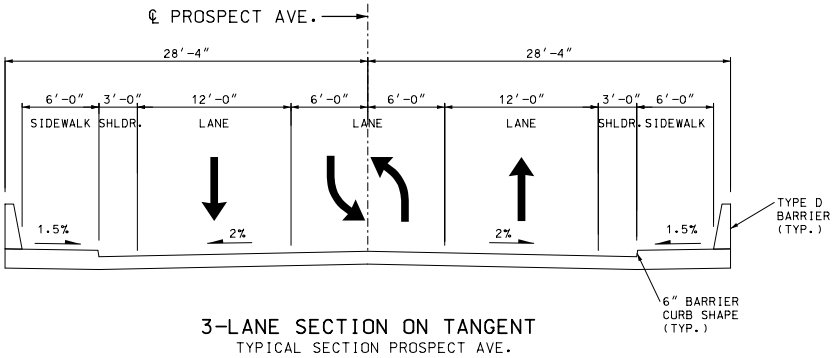


Figure 5 – Prospect Avenue Proposed 3-Lane Typical Section



2.0 Alternatives Development & Evaluation

Alternatives that incorporated bridge, mainline, interchange and arterial improvements were developed to address issues identified in the Project Purpose and Goals. The alternatives were primarily evaluated based on geometrics, right of way impacts, and construction costs to identify a preferred concept.

A range of bridge costs were estimated for different bridge types, including NU and steel girder bridges. A combination NU 43/ NU 35 estimate bridge cost can be found in **Exhibit A**.

The following section provides a summary of several different bridge alternatives with two conceptual vertical profiles for Prospect Avenue.

2.1 Conceptual Bridge Alternatives

2.1.1 NU 43 Prestressed Concrete Girder

- A NU 43 Girder bridge was evaluated to use for both spans of the Prospect Avenue bridge. This alternative resulted in a structure depth that was less desirable, but the cost was preferable.

2.1.2 Adjacent Box Beam

- An adjacent box beam bridge was also evaluated but it was decided to not move forward with this design as this is not a preferred MoDOT bridge type due to long-term performance, maintenance, inspection issues, and cost.

2.1.3 Combination NU 43/ NU 35 Prestressed Concrete Girders

- A combination NU 43/ NU 35 prestressed concrete girder option was also evaluated. This combination option allows for a reduced structure depth at the point of minimum vertical clearance when compared to the NU 43 option. NU 43 girders would be used over the WB I-70 lanes and NU 35 girders would be used over the eastbound I-70 lanes to provide the necessary minimum vertical clearance due to the downgrade of Prospect Avenue from north to south in addition to the superelevation transition present on eastbound I-70.

2.1.4 Steel Plate Girders

- Lastly a steel plate girder option was evaluated. One of the main benefits of using steel girders is that it allows for a reduced structure depth. However, steel girders are a more expensive option when compared to concrete NU girders.

2.1.5 Conclusion

- After evaluating the four different types of bridges that can be used, the combination NU 43/ NU 35 prestressed concrete girder option was selected as the preferred option. This option has a suitable structure depth that minimally impacts the roadway profile north and south of the bridge. Even though the structure depth is similar to the steel girder option, the combination NU 43/ NU 35 option is more economical.

2.2 Conceptual Vertical Profile A - Combo NU-43 & NU-35 Bridge (Min. North Impacts)

This option reduces the impact to existing ramp grades and businesses to the north of the bridge. See **Exhibit B** for the layout design of this alternative.

2.2.1 Prospect Avenue Design and Layout

- Horizontal Design: The horizontal alignment of Prospect Avenue remained unchanged from existing. South of I-70, 14th Street is connected to Wabash Avenue and is no longer merged with the I-70 EB off-ramp or on-ramp traffic.

- Vertical Design: Prospect Avenue was raised in order to increase the clearance height to 16'-6" assuming a structure depth of 47 inches over EB I-70. The profile meets or exceeds the proposed design criteria of 35 MPH with a minimum grade of 0.8% and a maximum grade of 6%.

2.2.2 I-70 WB On-Ramp Design and Layout

- Horizontal Design: The horizontal alignment of I-70 WB on-ramp was unchanged.

- Vertical Design: I-70 WB on-ramp includes a 45 MPH sag curve near the Prospect Avenue terminal.

2.2.3 I-70 WB Off-Ramp Design and Layout

- Horizontal Design: The horizontal alignment of I-70 WB off-ramp was unchanged.

- Vertical Design: I-70 WB off-ramp includes a 35 MPH crest curve near the Prospect Avenue terminal with an 8% vertical grade.

2.2.4 I-70 EB Off-Ramp Design and Layout

- Horizontal Design: The horizontal alignment of I-70 EB off-ramp was unchanged.

- Vertical Design: I-70 EB off-ramp includes a 45 MPH sag curve near the gore.

2.2.5 I-70 EB On-Ramp Design and Layout

- Horizontal Design: The horizontal alignment of I-70 EB on-ramp was unchanged.
- Vertical Design: I-70 EB on-ramp includes a 40 MPH crest curve near the Prospect Avenue terminal with a 7% vertical grade.

2.2.6 Right of Way Impacts

Due to improving the vertical clearance height of the Prospect Avenue bridge over I-70, the resulting roadway profile will impact right of way on the south side of the project. This may affect approximately three commercial driveways near the south tie-in. The right of way impacts are expected to be minimal, and preliminary design will strive to limit the impacts to the commercial driveways as construction easements only. There are no right of way issues along the ramps due to horizontal alignments being unchanged on all four ramps.

2.2.7 Conclusion

The benefits of this alternative include reducing impacts to the north of the bridge as well as reducing impacts to the north side ramps, especially the I-70 WB off-ramp which has a grade of 7.5% so tying the proposed ramp into the existing before the Chestnut Avenue bridge is critical. This alternative allows the ramps to be merged into the existing ramps more seamlessly at the cost of potentially impacting commercial driveways to the south of the bridge. See **Table 1** for all the advantages and disadvantages of this alternative over Alternative B.

Table 1: Conceptual Vertical Profile A - Combo NU-43 & NU-35 Bridge (Min. North Impacts)

Advantages	Disadvantages
Reduced impact to Prospect Avenue to the north of the bridge	Increased impacts to Prospect Avenue driveways to the south of the bridge
Reduced impact on I-70 WB off-ramp	

2.3 Conceptual Vertical Profile B – Combo NU-43 & NU-35 Bridge (Min. South Impacts)

This option reduces the impact to existing driveways to the south of the bridge. See **Exhibit C** for the layout design of this alternative.

2.3.1 Prospect Avenue Design and Layout

- Horizontal Design: The horizontal alignment of Prospect Avenue remained unchanged from existing. South of I-70, 14th Street is connected to Wabash Avenue and is no longer merged with the I-70 EB exit ramp or on-ramp traffic.

- Vertical Design: Prospect Avenue was raised in order to increase the clearance height to 16'-6" assuming a structure depth of 47 inches over EB I-70. The profile meets or exceeds the proposed design criteria of 35 MPH with a minimum grade of 0.8% and a maximum grade of 6%.

2.3.2 I-70 WB On-Ramp Design and Layout

- Horizontal Design: The horizontal alignment of I-70 WB on-ramp was unchanged.
- Vertical Design: I-70 WB on-ramp includes a 45 MPH sag curve near the Prospect Avenue terminal.

2.3.3 I-70 WB Off-Ramp Design and Layout

- Horizontal Design: The horizontal alignment of I-70 WB off-ramp was unchanged.
- Vertical Design: I-70 WB off-ramp includes a 35 MPH crest curve near the Prospect Avenue terminal with an 8% vertical grade. This option will need to be tied into the existing ramp further down the ramp than Conceptual Vertical Profile A.

2.3.4 I-70 EB Off-Ramp Design and Layout

- Horizontal Design: The horizontal alignment of I-70 EB off-ramp was unchanged.
- Vertical Design: I-70 EB off-ramp includes a 45 MPH sag curve near the gore.

2.3.5 I-70 EB On-Ramp Design and Layout

- Horizontal Design: The horizontal alignment of I-70 EB on-ramp was unchanged.
- Vertical Design: I-70 EB on-ramp includes a 40 MPH crest curve near the Prospect Avenue terminal with a 7% vertical grade.

2.3.6 Right of Way Impacts

Due to improving the vertical clearance height of the Prospect Avenue bridge over I-70, resulting roadway profile may impact right of way on the north and south side of the project. This may affect approximately two commercial driveways near the south tie-in and two commercial driveways near the north tie-in. There are no right of way issues along the ramps due to horizontal alignments being unchanged on all four ramps.

2.3.7 Conclusion

The benefits of this alternative include reducing impacts to the south of the bridge by not causing the profile to be raised as much on the south side. This alternative allows the ramps to be tied into the existing pavement but with steeper grade breaks. See **Table 2**

for all the advantages and disadvantages of this alternative when compared to Alternative A.

Table 2: Conceptual Vertical Profile B - Combo NU-43 & NU-35 Bridge (Min. South Impacts)

Advantages	Disadvantages
Reduced impact to Prospect Avenue to the south of the bridge	Increased impacts to Prospect Avenue driveways to the north of the bridge
	Increased impact on I-70 WB off-ramp

2.4 Drainage Evaluation

The proposed interchange concepts include similar impervious area conditions. As a result, significant increases in peak discharge and runoff volume are not expected. Drainage concerns outlined in Engineering Policy Guide (EPG) 748.1.4 will be considered. It is expected to maintain the existing drainage patterns, by avoiding the rerouting of drainage differently than the pre-project condition. The existing drainage systems in the area have unknown capacity but should have similar performance because the pre-project and post-project peak discharge(s) will nearly match. Coordination with the City of Kansas City, MO is ongoing during Core Team Meetings. If they were considered, groundwater recharge features are uncommon for highway construction to control runoff volume for MoDOT projects, and in this urban area they could negatively affect adjacent property basements and geotechnical conditions. According to the Federal Emergency Management Agency (FEMA) website, this project is not in any designated flood zone.

Generally, there are two primary existing drainage systems within the project extents.

The first is west of Prospect Avenue, that flows in a combined sewer system, into a 36” north to south trunk along the Olive Street corridor.

The second is east of Prospect Avenue, that flows in a storm sewer in the depressed portion of I-70, into a west to east trunk, that leads to a north to south trunk east of Benton Boulevard.

In areas where existing ramps will be removed, it will be necessary to maintaining existing drainage patterns, using ditches or area inlets, which may influence the construction limit or retaining wall heights.

Where curb is proposed in locations where drainage is currently conveyed to adjacent ditches in the existing condition due to right of way constraints, closed drainage systems will be necessary. Low points confined by curbs may require drainage inlets to be designed to intercept the runoff condition for major events from that point downstream, if dedicated storm sewers are constructed in the future.

The existing Prospect Avenue bridge has no deck drainage, and it is 60-ft wide. Current criteria (EPG 751.10.3.1) require spread to be no greater than the shoulder width plus 3-ft, for minor

roads with <45 mph design speed. Conceptually the proposed bridge spread condition requires deck drains on each alternative:

- 4 lanes with no shoulder (3-ft spread allowed)
- 4 lanes with 1-ft shoulder (4-ft spread allowed)
- 3 lanes with 3-ft shoulder (6-ft spread allowed)

The bridge deck drainage would need to be collected from north to south along each fascia, piped through the south abutment, then emptied into the southern bridge end drain inlet(s). Or MoDOT may opt to pursue a design waiver, understanding the roadway spread criteria (shoulder plus ½ lane, per EPG 640.1.2.2) is not as stringent at the bridge spread criteria. For local roads governed by KCMO American Public Works Association (APWA) criteria there is no differentiation between roadway and bridge spread requirements. The allowable spread will be further evaluated during preliminary design.

2.5 Traffic and Safety

Traffic models are being developed to analyze traffic operations along Prospect Avenue between Truman Road and 12th Street for the proposed interchange concepts. These models will include the entrance and exit ramps to and from I-70. At this time, mainline I-70 through the Prospect Avenue interchange has been accounted for in traffic analysis performed for the I-70 Conceptual Access Justification Request (AJR) completed and approved in 2017. Therefore, I-70 will not be included in the traffic models being developed for this project. Once a preferred concept has been established, it will be shared with the Federal Highway Administration (FHWA). At that time, it will be determined if additional traffic analysis will be needed along I-70 to update the previously approved AJR.

To aid in the development of the traffic models. Peak period intersection turning movement counts were collected at all the intersections along Prospect Avenue within the model limits on October 7, 2021. These volumes will be used when developing the existing conditions model. When analyzing the proposed concepts, the existing traffic volumes will be projected to develop future year (2050) volumes using a growth rate of 0.25% per year.

An existing safety analysis was performed for the Prospect Avenue corridor using data from MoDOT's crash database for the years 2016 to 2020. This analysis also included portions of the side-street arterials between Truman Road and 12th Street that intersect Prospect Avenue. Overall, about 70% of the crashes that occurred during the analysis years were property damage only crashes. The most common crash types were right-angle and rear-end with a majority of the crashes occurring at the intersections along Prospect Avenue.

There were six (6) pedestrian crashes along the corridor during the analysis years. Three of these crashes occurred at the Truman Road intersection, two of the crashes occurred at the EB I-70 ramps intersection and the remaining crash occurred at 12th Street. Since the last pedestrian crash, which occurred in 2020, the intersections and traffic signals along Prospect Avenue have been upgraded to include pedestrian accommodations that comply with the Americans with Disabilities Act (ADA). These upgrades are expected to help reduce the number

of pedestrian related crashes along the corridor. This project will maintain these improvements as well as reconstruct the sidewalk on both sides of Prospect Avenue. Disconnecting 14th Street from the ramps south of I-70 allows for a larger refuge island for pedestrians crossing the west leg of the Prospect Avenue and EB I-70 exit ramp intersection. This larger refuge island will increase pedestrian safety at this location.

Currently, MoDOT is working to review the crashes within the interchange area and get them coded to the correct location in their database. Once the updated data is available, the existing safety analysis will be revised.

2.6 Maintenance of Traffic During Construction

During construction, Prospect Avenue will be closed to through traffic between the I-70 ramp terminals. Detours routes for local traffic including buses and emergency vehicles will need to be coordinated with Kansas City Area Transportation Authority (KCATA) and KCMO. The I-70 ramps will remain open during much of the construction as well as eastbound and westbound I-70 traffic. Intermittent weekend or evening closures on I-70 will be required during bridge demolition and to erect the bridge girders. The inside lanes of I-70 will be closed to construct the median bridge column and concrete median barrier. The outside lanes of I-70 may be impacted to construct the bridge abutment and retaining walls. For any closures along I-70, the travelling public will receive advance notice and closures will be coordinated with major holidays and any known large public events in the metropolitan area.

2.7 Environmental and Cultural Impacts

No environmental or cultural impacts are anticipated for the construction of the Prospect Avenue bridge. The project is within existing right of way and is not located next to any natural resources. The Prospect Avenue bridge itself is also not a cultural resource and no cultural resources are located within the project's area of potential effects.

3.0 Preferred Concept

Based on the findings of the Project Purpose and Goals and the Alternatives Development & Evaluation, the Preferred Concept is presented in this section.

3.1 Preferred Concept

After thorough evaluations, discussions with the MoDOT core team and the city, and after comparing the two alternatives, the preferred concept for this corridor is a four-lane Prospect Bridge typical section with a combination NU 43/ NU 35 prestressed concrete girder bridge following the Vertical Profile A alternative, for minimum impacts to the north of the bridge. This option provides a bridge with the required minimum vertical clearance, preferred structure depth and a reasonable cost when using prestressed concrete when compared to steel. The Vertical Profile A alternative allows for easier construction along the ramps but at a cost of more work along Prospect Avenue to the south. As mentioned previously, traffic analysis is ongoing for a

four-lane vs. three-lane Prospect Avenue typical section; pending results of this investigation, a three-lane may be chosen during preliminary design to reduce the impacts of the improvement.

3.1.1 Traffic Operations

This alternative will have minimum impacts to traffic due to the number of lanes along Prospect Avenue matching the existing four lane condition and no changes in the general layout of the ramps at Prospect Avenue. In this alternative, 14th Street south of I-70 will be disconnected from the I-70 ramps. This will have minor impacts to traffic operations along 14th Street south of I-70 since traffic volumes are fairly low and there are alternate routes available for drivers to use. In addition, separating the ramps from 14th Street will increase safety along the ramps and provide more efficient traffic operations at the Prospect intersection since the through traffic movement will be removed. The results of the future traffic operational analysis and typical sections along Prospect will be coordinated with KCMO.

3.1.2 Bridge

The proposed bridge will improve the vertical clearance over I-70 to 16-6". There are two options for the bridge length. Both options would utilize NU P/S girders. The first option places the bridge limits next to the proposed roadway. This created a bridge length of approximately 193 ft., resulting in a superstructure depth of 55" and 47" over the WB and EB I-70 spans, respectively. This option also requires retaining walls built parallel to I-70. The second option uses open end span and eliminates the need for retaining walls. However, this option was quickly dismissed as the proposed bridge would be longer than the existing bridge given the future widening of I-70 and would interfere with the I-70 on and off ramps immediately north and south of the bridge location.

3.1.3 Summary of Preferred Concept

Overall, the Preferred Concept improvements provide safety and mobility enhancements over existing conditions and provide for future conditions. It has the ability to avoid new right of way and allows for future I-70 improvements, while also improving current traffic conditions. **Exhibit D** shows the cost estimate for this concept, which results in an estimated cost of $4,422,000 in 2023 dollars.

Exhibits

Exhibit A: Bridge Concept Study

HNTB The HNTB Companies
Engineers Architects Planners

Job Number 78501

For J4S3374 - Jackson County - Prospect Over Over I-70

Sheet No.

Prospect Over I-70
Concept Study

		North Span			South Span			Bridge Geometry				
Span Layout * (North-South)	Bridge Type	Min Per AASHTO T2.5.2.6.3-1 (in.)	NU Girder Type	Structure Depth (in.) **	Min Per AASHTO T2.5.2.6.3-1 (in.)	NU Girder Type	Structure Depth (in.) **	Length (ft)	Width (ft) ***	Area (sf)	2021 Bridge $/sf ****	**2021 Bridge Cost**
103'-90'	NU P/S Gdrs.	55	43	55	48	35	47	193	64.67	12,481	$155	**$1,935,000**

* MoDOT Std Dwg. MSEW_03 notes 3'-9" from back of MSE wall to face of end bent. Conservative MSE wall panel thickness is 12". Face of end bent to CL Brg is 15" per MSEW_03. Total offeset required is 6.00 ft +/- measured normal to wall. Assume Type D barrier in front of MSE walls at edge of shoulders. Estimate skew angle as 24 degrees. Use typical section for future I-70 provided by roadway on 11/11/2021.

** Does not include bridge cross slope or super elevation.

*** Assumed four lane typical section as shown in concept report.

**** Cost per square foot includes cost to build bridge plus existing bridge removal, bridge approach slabs (major), fencing (as needed), and any utility conduits. 15% contingency is not included herein but is included in overall project summary.

E. 13 ST.

OLIVE ST.

WABASH ST.

RETAINING WALL

PCT STA 10+00.00

10

WB I-70

EB I-70

E 14TH ST.

RETAINING WALL

POINT OF MIN. VERT. CLEARANCE

E. 14 ST.

CHESTNUT AVE.

MONTGALL AVE.

PROSPECT AVE.

EXIST. R/W

EXIST. R/W

POT STA 15+00.00

15

E 14TH ST.

OLIVE ST.

WABASH ST.

SCALE

0 50 100 150

PROSPECT AVENUE
VERTICAL PROFILE A PLAN VIEW

Exhibit B, Drawing 1
Prospect Avenue Vertical Profile A
Plan View

"THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT."

DATE PREPARED
1/20/2022

ROUTE	STATE
I-70	MO
DISTRICT	SHEET NO.
KC	

COUNTY
JACKSON

JOB NO.
J4S3374

CONTRACT ID.

PROJECT NO.

BRIDGE NO.

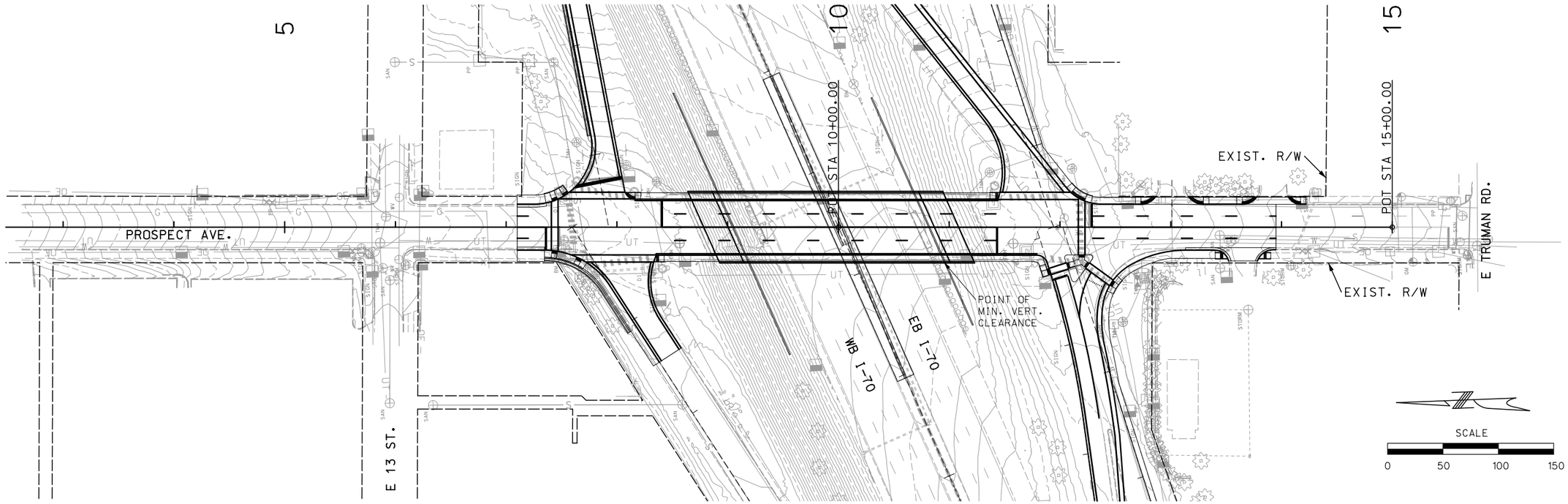
IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

REV.	DATE	DESCRIPTION

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

HNTB
715 KIRK DRIVE
KANSAS CITY, MO 64105-1310
TELEPHONE (816) 472-1201
CERTIFICATE OF AUTHORITY
NO. 001270

OverallPlanExhibit_J4S3374_I50.dgn 8:51:47 AM 1/20/2022



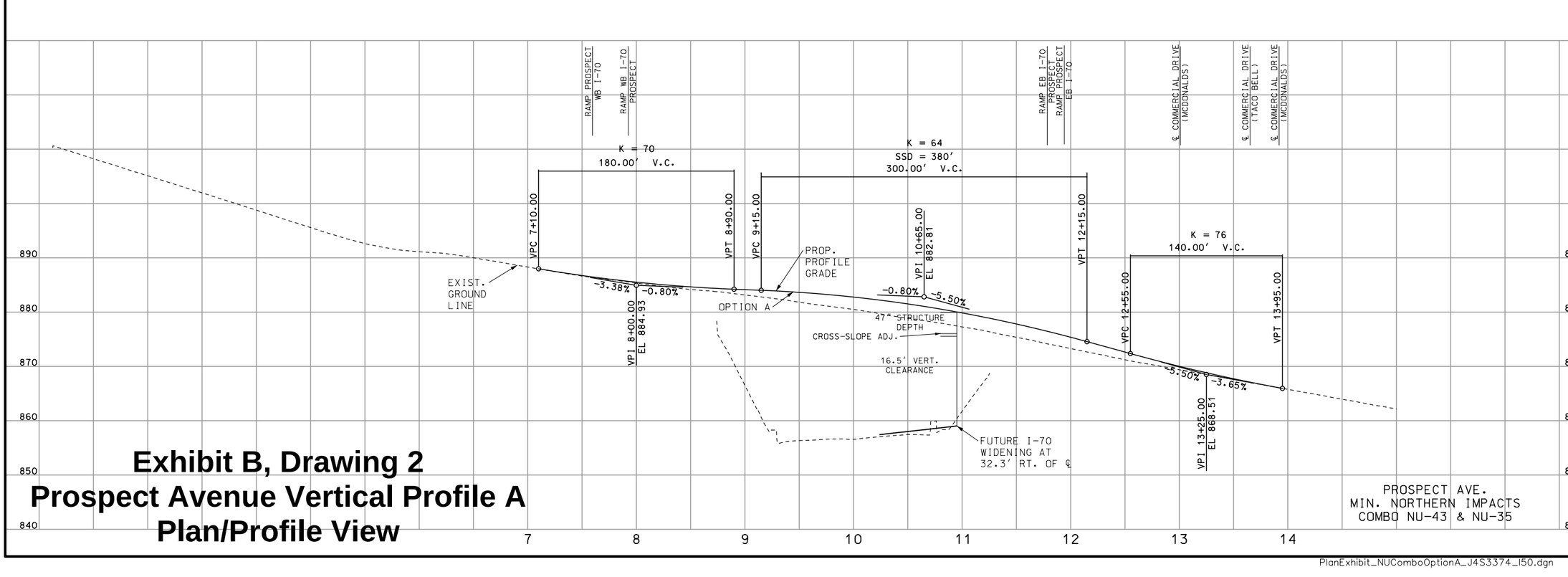


Exhibit B, Drawing 2
Prospect Avenue Vertical Profile A
Plan/Profile View

"THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT."

DATE PREPARED 1/19/2022

ROUTE	STATE
I-70	MO
DISTRICT	SHEET NO.
KC	

COUNTY: JACKSON
JOB NO.: J4S3374
CONTRACT ID.:
PROJECT NO.:
BRIDGE NO.:

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

REV.	DESCRIPTION	DATE

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

HNTB
715 KIRK DRIVE
KANSAS CITY, MO 64105-1310
TELEPHONE (816) 472-1201
CERTIFICATE OF AUTHORITY NO. 001270

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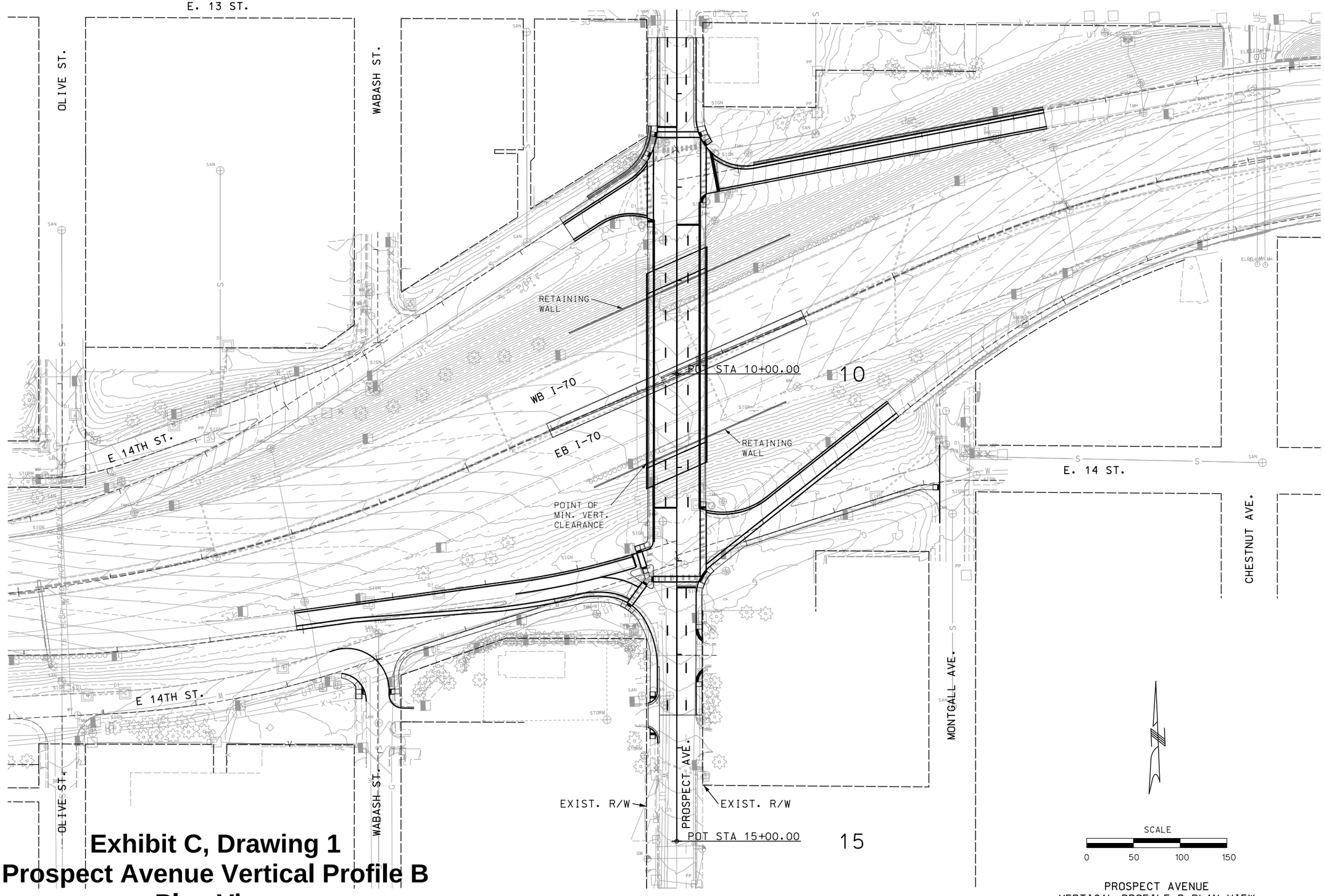

Exhibit C, Drawing 1
Prospect Avenue Vertical Profile B
Plan View

PROSPECT AVENUE
VERTICAL PROFILE B PLAN VIEW

"THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT."

DATE PREPARED
1/20/2022

ROUTE	STATE
I-70	MO
DISTRICT	SHEET NO.
KC	

COUNTY
JACKSON

JOB NO.
J4S3374

CONTRACT ID.

PROJECT NO.

BRIDGE NO.

DATE	DESCRIPTION

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL
JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

HNTB
715 KIRK DRIVE
KANSAS CITY, MO 64105-1310
TELEPHONE (816) 472-1201
CERTIFICATE OF AUTHORITY
NO. 001270

REV.

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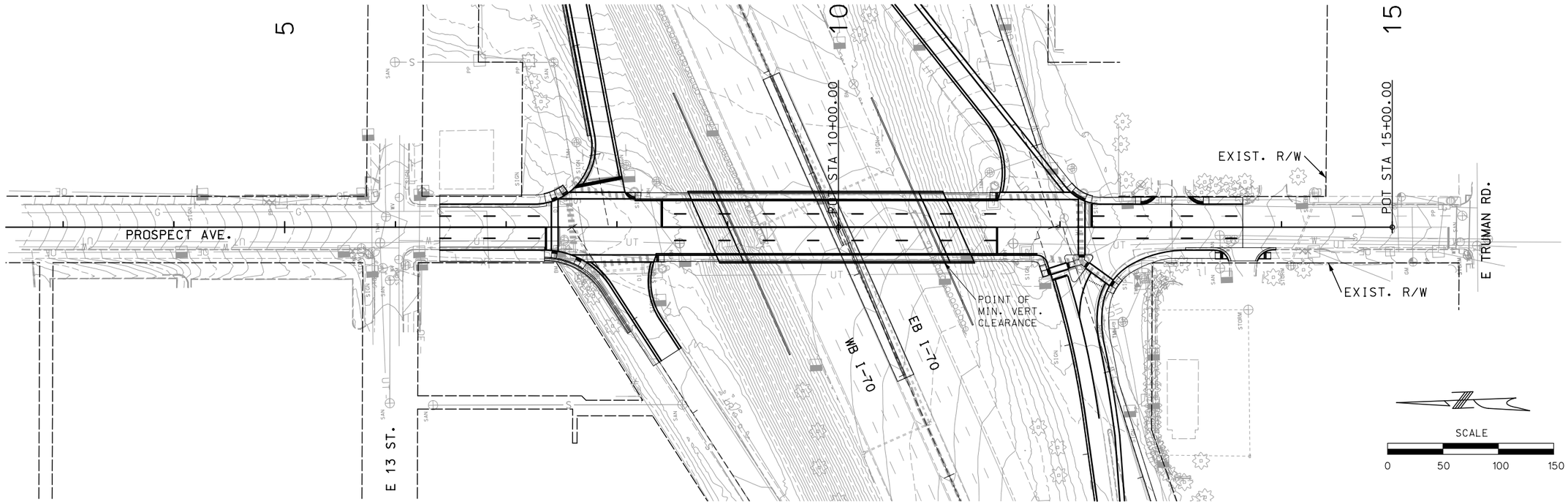

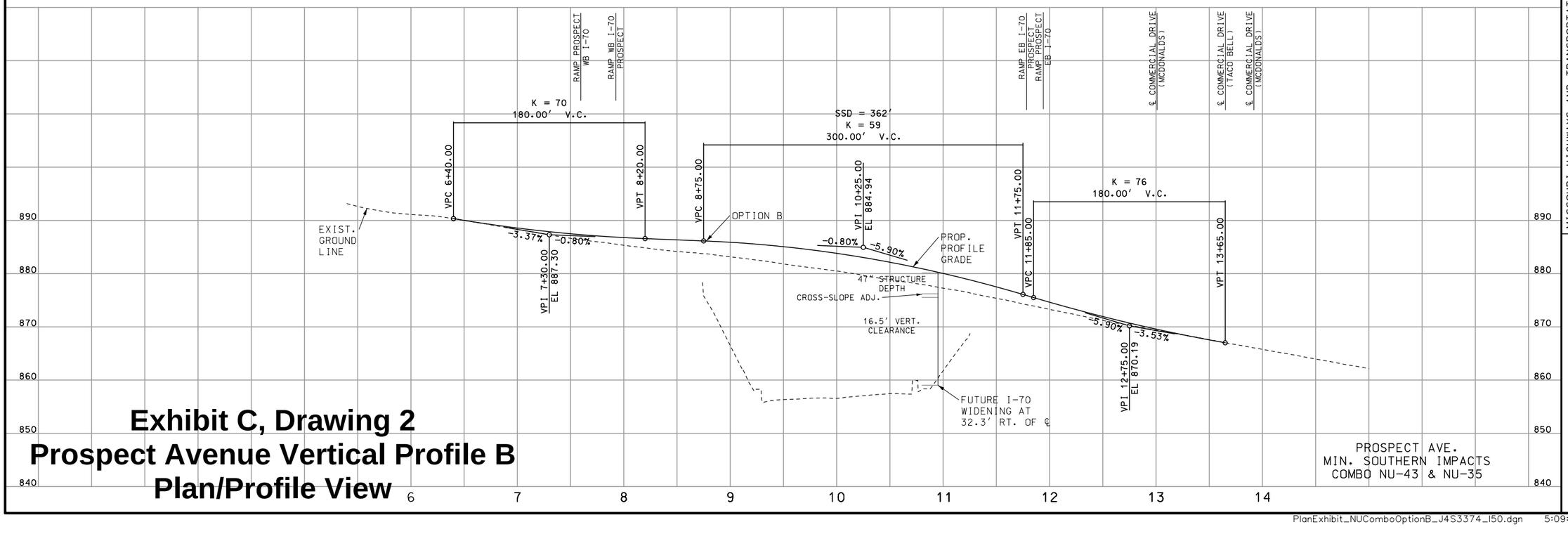

Exhibit C, Drawing 2
Prospect Avenue Vertical Profile B
Plan/Profile View

"THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT."

DATE PREPARED
1/19/2022

ROUTE	STATE
I-70	MO
DISTRICT	SHEET NO.
KC	

COUNTY
JACKSON

JOB NO.
J4S3374

CONTRACT ID.

PROJECT NO.

BRIDGE NO.

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Exhibit D: Cost Estimate

HNTB

MoDOT Project # J4S3374 - Prospect over I-70
ENGINEER'S ESTIMATE OF PROBABLE COST
January 19, 2022

ITEM	TOTAL
BRIDGE & RETAINING WALLS	$ 2,357,000
MISC (MOBILIZATION, STAKING, LIGHTING, TRAFFIC CONTROL)	$ 552,000
GRADING & DRAINAGE	$ 63,000
SURFACING (PAVEMENT, SIDEWALK, CURB)	$ 743,000
PROJECT SUBTOTAL (FY '22 dollars)	$ 3,715,000
Contingency	*15%*
Add Inflation (1 year at 3.5%/yr)	*3.50%*
PROJECT CONSTRUCTION TOTAL (FY '23 dollars)**	$ 4,422,000

**Estimate does not include Noise Walls, Right of Way, Permitting, Utility Relocation, or Design/Construction Engineering costs

The costs shown in this estimate represent an estimate of probable costs prepared in good faith and with reasonable care. HNTB has no control over the costs of construction labor, materials, or equipment, nor over competitive bidding or negotiation methods and does not make any commitment or assume any duty to assure that bids or negotiated prices will not vary from this estimate of costs.

DESIGN CRITERIA

Roadway

DESIGN SPECIFICATIONS **COMMENTS**

A. GOVERNING CRITERIA

1. AASHTO, *A Policy on Geometric Design of Highways and Streets, "Green Book"*, 7th Edition, 2018
2. AASHTO, *Roadside Design Guide*, 4th Edition, 2011
3. ATSSA/AASHTO/ITE, *Manual on Uniform Traffic Control Devices for Streets and Highways, "MUTCD"*, 2009 Edition
4. ADA, 2010 *ADA Standards for Accessible Design*
5. Transportation Research Board, *2016 Highway Capacity Manual (HCM 2016)*, 6th Edition
6. Illuminating Engineering Society of North America, Roadway Lighting – *ANSI Approved RP-8-14*

B. ADDITIONAL REFERENCES

1. MoDOT Engineering Policy Guide.
2. 2021 Missouri Standard Plans for Highway Construction (Effective 10-01-21).
3. 2021 Missouri Standard Specification Book for Highway Construction (Effective 10-01-21).

C. UNITS

1. The roadway elements shall be designed using English Units.
2. The units shown in the preliminary and final plans shall be English Units.

D. LAYOUT

1. Design Speeds:

Alignment	Functional Classification	Design Speed*
Prospect Avenue	Minor Arterial	35 mph
Prospect Ramps	Arterial Ramp	35 mph 45 mph at gore
I-70	Interstate	55 mph
14th Street	Local	25 mph

*All design speeds match existing posted speeds.

2. Typical Roadway Lane/Shoulder Widths:

Alignment	Lane Width	Shoulder Width		Sidewalk
		Inside	Outside	
Exist. Prospect Bridge	12’	NA	N/A	5’ (both sides)
	48’ roadway width			
Prospect Bridge	12’	NA	1’	6’ min. (both sides)
	50’ roadway width			
Prospect Roadway (Bridge Approaches)	12’	N/A	1’	5’ min. (both sides)
	50’ roadway width			
Prospect Ramps	14’	2’-4’	2’-4’	N/A
	18’-22’ roadway width			
I-70	12’	7’ (Exist.)	8’ WB (Exist.) 20’ EB (Exist.)	N/A
	128’ roadway width (Exist.)			
14th Street	22’	N/A	C&G	5’ min.
	22’ roadway width			

Includes turn lanes for on-ramps

3. Minimum Clear Zone:

Alignment	Clear Zone	
Prospect Avenue	12’ (slopes≤6:1), 14’ (slopes>6:1)	Assumed ADT 1500 - 6000
Prospect Ramps	12’ (slopes≤6:1), 14’ (slopes>6:1)	Assumed ADT 1500 - 6000
I-70	22’ (slopes≤6:1), 26’ (slopes>6:1)	Assumed ADT Over 6000
14th Street	7’ (slopes≤6:1), 7’ (slopes>6:1)	Assumed ADT Under 750

4. Minimum Vertical Clearance:

Alignment	Vertical Clearance	
Prospect Bridge over I-70	16’-6”	Meet or exceed existing vertical clearance (currently 14’-9”) Desired 16’-6”

5. Maximum Superelevation:

Alignment	Superelevation
Prospect Avenue	4%
Ramps	6%

6. Profile Grade:

Alignment	Min. Profile Grade	Max. Profile Grade	
Prospect Avenue	0.5%	6%	
I-70	0.5%	5%	
Ramps	0.5%	6%	I-70 WB off-ramp & I-70 EB on-ramp exceed 6%
14th Street	0.5%	7%	

7. Survey Datum
   a. Horizontal – State Plane, Missouri West Zone, NAD 1983
   b. Vertical – NAVD 88

Bridge

COMMENTS

DESIGN SPECIFICATIONS

A. GOVERNING CRITERIA

1. AASHTO *LRFD Bridge Design Specifications,* Customary U.S. Units, 9th Edition, 2020
2. ASTM Standards, current as of 09-01-21

B. ADDITIONAL REFERENCES

1. MoDOT Engineering Policy Guide effective as of September 1, 2021
2. Missouri Standard Plans Book for Highway Construction, 2020
3. Construction Specifications
   a. *Missouri Standard Specification for Highway Construction*, October 1, 2021
   b. Job Special Provisions, as required
4. AASHTO/AWS D1.5M/D1.5:2020 Bridge Welding Code

NOTE: MoDOT 2020 Construction Standard Specifications reference the 2002 Welding code.

5. "Design of Bridge Deck Drainage," Publication No. FHWA-SA-92-010
6. NSBA "Steel Bridge Design Handbook"

C. UNITS

1. The bridges shall be designed using English Units.
2. The units shown in the final plans shall be English Units.

D. LAYOUT

1. The spans, bridge widths, and general arrangement for each structure will be as noted in the Bridge Memorandum.
   a. Bridge layout to accommodate existing and potential future widening of I-70.
   b. Bottom of Retaining Walls (if used) shall be controlled by the lower of the future widening of I-70 or proposed ground line for this project. Bottom of wall shall be set 3 ft min. (or as dictated by Geotechnical Engineering Report) below the controlling elevation.

2. Traffic Railings & Fences

   a. MoDOT Type D Concrete Barrier, 42” tall shall be used.

3. Sidewalks & Fences

   a. Sidewalks on the bridge (i.e. parallel to Prospect) are pending per concept study.

   b. Fence to be used along top of retaining walls parallel to I-70.

      (1) Fence shall be chain link.

   c. Fence to be used along sidewalks parallel to Prospect (if applicable).

      (1) Fence details to be determined in coordination to MoDOT and local stakeholders.

4. Minimum Vertical Clearance

   a. I-70: 16’-6” measured to lower lane or shoulder.

   b. Bridge shall meet minimum vertical clearance for future widening of I-70.

5. Minimum Horizontal Clearance

   a. I-70: See roadway design criteria.

   b. Prospect: See roadway design criteria.

6. Water elevation and average velocities

   a. N/A.

E. DESIGN LOADS

1. Design loads will be in accordance with AASHTO LRFD Chapter 3 and MoDOT EPG Section 751.2.

2. Earthquake Effects (EQ)

   a. Performance Criteria

      (1) The bridge shall be designed for the life safety performance objective. Prospect over I-70 is considered to be an “Other Bridges” per AASHTO 3.10.5 as it is considered to be non-critical/non-essential. This bridge shall have a low probability of collapse for the design earthquake and may suffer severe damage which may cause significant disruptions to service.

F. LIMIT STATE COMBINATIONS

1. Limit state combination shall be in accordance with AASHTO Article 3.4, Table 3.4.1-1 and MoDOT EPG 751.2.3:

2. The factor γ_{EQ} for live load in combination with seismic loads for Extreme Event I shall be 0.0.

3. Load modifiers relating to Ductility, η_D, Redundancy, η_R, and Operational Importance, η_I, are to be taken as follows for all structures:

   a. $\eta_D = 1.00$

   b. $\eta_R = 1.00$

   c. $\eta_I = 1.00$

G. MATERIALS

1. Materials and material properties shall be consistent with AASHTO and guidelines noted in MoDOT EPG 751 unless approved by MoDOT Structural Project Manager.

MISCELLANEOUS DESIGN

H. PROTECTIVE COATINGS

1. Concrete and Masonry Protection System plus Graffiti protection will be applied:

   a. To all MSE wall surfaces.

   b. To all substructure elements within 20 ft of the ground.

   c. To concrete targeted for graffiti including the cross roads barrier sides adjacent to the pedestrian walkways.

Drainage

A. GENERAL

These criteria have been developed to provide a summary of methodologies and standards to be used for the design of this project from a drainage and hydraulics standpoint.

The drainage system includes: closed drainage systems, culverts, drainage flumes, and ditches, required to:

1. Maintain existing drainage patterns
2. Meet spread requirements for the design storm
3. Minimize the risk of erosion from runoff

Drainage design is based on the US Customary English units as defined in these criteria.

These criteria are provided for guidance and are no substitute for experience or engineering judgement.

B. DESIGN STANDARDS & SPECIFICATIONS

The following publications are to be used in conjunction with these criteria, as guides in developing the plans for this project.

1. Engineering Policy Guide, MoDOT, version as of October 1, 2020, especially:
   a. 604 Miscellaneous Drainage
   b. 609 Paved Drainage
   c. 640 Pavement and Median Drainage
   d. 726 Rigid Pipe Culverts
   e. 731 Precast Reinforced Concrete Manholes and Drop Inlets
   f. 732 Flared End Sections
   g. 748 Hydraulics and Drainage
   h. 749 Hydrologic Analysis
   i. 750 Hydraulic Analysis
   j. 751.10 General Superstructure - Bridge Deck Drainage
2. Missouri Standard Plans for Highway Construction, 2020
3. Missouri Standard Specifications for Highway Construction, 2020
4. "Drainage of Highway Pavements", FHWA Hydraulic Engineering Circular No. 12 (HEC-12), March 1984

5. "Design of Bridge Deck Drainage", FHWA Hydraulic Engineering Circular No. 21 (HEC-21), FHWA- SA-92-010, May 1993
6. "Urban Drainage Design Manual", FHWA Hydraulic Engineering Circular No. 22 (HEC-22), FHWA-NHI-10-009, September 2009

C. HYDROLOGIC ANALYSIS

1. Methodology

The Rational Method will be used for computing stormwater runoff peak discharges, related to roadway and ditch drainage, as all watershed drainage areas should be less than 200 acres.

1.1 Rational Method - the following form of the Rational Method formula will be used:

$$Q = kCiA$$

where: Q = peak discharge, cfs
k = dimensionless coefficient to account for antecedent precipitation
C = runoff coefficient (dimensionless) i = rainfall intensity, in/hr
A = watershed area, acres

a. The following dimensionless coefficient will be used to account for antecedent precipitation; except the product of the k times C shall not exceed 1.0 (see EPG 749.5.2.3)

Frequency (years)	k
10 and less	1.0
25	1.1
50	1.2
100	1.25

b. The runoff coefficient is a function of soil type and land use of the watershed.

The following coefficients will be used:

Description	Coefficient "C"
Paved Surfaces	0.90
Highway Slopes & Ditches	0.50

For other land uses/zoning, refer to the runoff coefficients listed in 749.5.2.2 (urban) of MoDOT's Engineering Policy Guide.

c. The design intensity is a function of storm duration, the frequency, and the geographic location. The storm duration is defined as the time of concentration. Time of concentration calculations will be based on the MoDOT's Section 749.5.3 of the Engineering Policy Guide. The minimum time of concentration shall be 5 minutes.

d. The rainfall intensity, duration and frequency curves, for this Kansas City District project, can be found in the MoDOT Engineering Policy Guide Section 749.5.4.

D. PAVEMENT DRAINAGE

1. Method used to estimate design flow - Rational Method

2. Design Frequency – dependent upon location (per EPG 640.1.2.1) – *likely not applicable*, replaced in-kind, understanding receiving City combined sewer system has limited capacity.

   a. on grade and non-critical low points 10 yr (7.94in/hr 5 min)

   b. low points at critical locations (minor roadway) 25 yr (9.46in/hr 5 min)

   c. low points at critical locations (major roadway) 50 yr (10.75in/hr 5 min)

3. Time of Concentration - sum of overland and gutter flow time, with a minimum total of 5 minutes

4. Based on MoDOT's Engineering Policy Guide Section 640.1 Pavement Drainage and Section 751.10.3 Bridge Deck Drainage, criteria is:

   a. I-70 Ramps, Prospect Roadway, Adjacent Streets and Connectors Pavement - *not applicable*, replaced in-kind, understanding receiving City combined sewer system has limited capacity

   b. Prospect Bridge Deck
      - Maximum spread for Minor roadway < 45 mph = shoulder + 3ft
      - Design Analysis
        - Rational "C" of 1.0
        - 10-yr return period, 10 min Tc (per 751.10.3)
        - Rainfall intensity of 5.89in/hr

E. STORM SEWERS

1. Method used to estimate design flow - *not applicable*, replaced in-kind, understanding receiving City combined sewer system has limited capacity.

2. Design & Check Frequency HGL- *not applicable*, replaced in-kind, understanding

receiving City combined sewer system has limited capacity.

3. Time of Concentration – *not applicable*, replaced in-kind, understanding receiving City combined sewer system has limited capacity.

4. Method for hydraulic analysis - *not applicable*, replaced in-kind, understanding receiving City combined sewer system has limited capacity.

5. Minimum Slope – see EPG 750.4.2.4, to achieve 3 feet per second when flowing full

6. Minimum Pipe Size – 15 in. for closed drainage and 18 in. for open ended culverts, unless existing system downstream is lesser size.

7. Minimum Cover - top outside of pipe 6 in. below bottom of rock base course

8. Maximum length of pipe between manholes or access points, per 750.4.2.5

   a. 15 in. diameter 400 ft.

   b. 18 in. diameter and greater 500 ft.

9. Pipe Type –per EPG 750.7.2

10. Pipe Roughness – n = 0.013 implied per EPG 750.7.2.6

11. Pipe Installation Method – depends on contractor selected pipe type per Standard Plans 726.30 and 730.00

F. CULVERTS

1. None expected.

G. DETENTION

1. None expected.

H. DITCHES

1. Method used to estimate design flow - Rational Method

2. Design Frequency - 10 years

3. Design Methodology - as directed in the MoDOT's Section 750.1 Open Channels in the Engineering Policy Guide.