

Memo



To: Rick Bruce, PE, PS [ODOT]
Adam Johnson, PE [FHWA]
C: Gary Cochenour, PE
From: Tom Barnitz, PE *AB*
Date: May 19, 2009
Re: SCI-823-6.81 [PID No. 19415]
Modifications to Stage 1 Design for Phase 1

Please find attached a copy of the referenced documents for your review and approval.

In summary, the modifications reduce the amount of rock excavation for the Phase 1 design by slightly raising the vertical profile in certain locations and relocating the CR 28 interchange approximately 300 feet. An extended merge lane on Ramp A of TR 234 was designed to mitigate the reduction in truck merge speed that was realized with the ramp changes.

No significant additional ROW or environmental impacts beyond the approved Stage 1 plans are anticipated. Slight lengthening of some culverts is expected due to the wider embankment base. No additional residences or businesses are affected.

These modifications to Stage 1 maximize the investments in this facility and will have an overall reduction in cost of approximately \$5 million, while maintaining the safety, operation, and geometric standards of the highway.

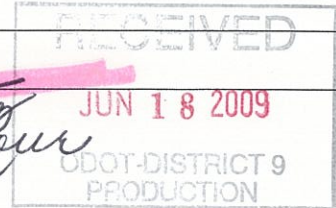
The documents attached are as follows:

1. Memo dated May 11, 2009 - Stage 2 Modifications to Approved Stage 1 Plans
2. Meeting Notes dated April 23, 2009
3. Exhibit: SR 823 Mainline Profile
4. Exhibit: TR 234 Interchange
5. Exhibit: CR 28 Interchange

Should you need additional information, please contact me at your convenience.

Thanks

To: Tom Barnitz, PE, ODOT D9	
From: Brad Hyre, PE, HDR	Project: SCI-823-6.81; PID 19415
CC:	
Date: May 11, 2009 (revised June 12, 2009)	Job No: 45878



**RE: SCI-823-6.81, PID No. 19415
Portsmouth Bypass Phase 1
Stage 2 Modifications to Approved Stage 1 Plans**

A Value Engineering (VE) Study for the entire Portsmouth Bypass project was held by ODOT in December 2007. Based on the VE recommendations (see January 28, 2008 report), further investigation was initiated regarding potential changes to the mainline profile that would significantly reduce project excavation and waste (VE Alternative 2/30). The subsequent investigation (see December 4, 2008 report) found that there could be a significant savings in construction cost if the Stage 1 profile was revised. A study was also undertaken of the CR 28 Interchange (see April 17, 2009 report) to determine if adjusting the design of the interchange could also result in a reduction of excavation and project waste. Based on the analysis, it was estimated that a significant savings in construction costs (based on Alternative 1) could also be expected if the Stage 1 interchange design was revised.

This memo (and scroll plot exhibits) documents the changes to be made to the approved Stage 1 design of the subject project as a result of the above VE studies and a subsequent review meeting by ODOT District 9, ODOT ORE, ODOT OGE, and FHWA on April 23, 2009. The proposed changes agreed to at the meeting and documented herein are estimated to save approximately \$5 million in construction costs without adversely affecting the safety and operation of the facility. These changes and any final adjustments will be incorporated into the Stage 2 plans; a summary of the major changes are detailed below (see attached exhibits for detailed profiles and interchange plans).

- SR 823 profile modified from Station 387+00 to 543+55:
 - Steepened and raised the profile grade from +1.5% to +2.9% from Stations 387+00 to 422+00.
 - Shifted VPIs to raise the profile from Stations 442+00 to 470+20; flattened ahead grade to +1.5% from +2.6%.
 - Shifted VPIs to raise the profile from Stations 489+40 to 536+55; slightly steepened grade approaching CR 28 from -2.90% to -2.99%.
 - Tied back to Stage 1 (Phase 2) profile elevation at Station 543+55 with ahead grade of +4.00%.
 - All vertical curves meet the 70 mph design speed; Stage 1 maximum 4.5% grades were maintained.
- Modified TR 234 Ramp A profile
 - Shifted VPIs to raise the profile; steepened predominant grade to +4.97 from +4.88; set tie-in grade at +2.9% to match the SR 823 grade.
- Modified TR 234 Ramp D profile
 - Adjusted VPIs to raise the profile; steepened predominant grade to +2.80% from +1.91%; set the tie-in grade at +3.40% to match the elevations controlled by the SR 823 grade.
- Modified acceleration length for TR 234 Ramp A. Provided an auxiliary lane from Station 409+50 to 428+00 (800 ft beyond high point of SR 823); utilized a 50:1 taper to Station 434+00 to drop the lane. This change is required to mitigate the reduction of truck speeds due to the modified profiles.
- Modified CR 28 Interchange by shifting the interchange/ramps to the north approximately 300 ft.
 - New horizontal and vertical geometry for all ramps due to revised location; overall configuration remains the same.
 - Maintained or improved Stage 1 degree of curves.
 - Ramp A profile features a -5.97% max grade, Ramp B +5.87%; all others less than 4.3% and similar to Stage 1.
- Bridges over Swauger Valley Road and SR 139 to be revised to meet the profile changes.

To: Tom Barnitz, PE, ODOT D9	
From: Brad Hyre, PE, HDR	Project: SCI-823-6.81; PID 19415
CC:	
Date: May 11, 2009	Job No: 45878

**RE: SCI-823-6.81, PID No. 19415
Portsmouth Bypass Phase 1
Stage 2 Modifications to Approved Stage 1 Plans**

A Value Engineering (VE) Study for the entire Portsmouth Bypass project was held by ODOT in December 2007. Based on the VE recommendations (see January 28, 2008 report), further investigation was initiated regarding potential changes to the mainline profile that would significantly reduce project excavation and waste (VE Alternative 2/30). The subsequent investigation (see December 4, 2008 report) found that there could be a significant savings in construction cost if the Stage 1 profile was revised. A study was also undertaken of the CR 28 Interchange (see April 17, 2009 report) to determine if adjusting the design of the interchange could also result in a reduction of excavation and project waste. Based on the analysis, it was estimated that a significant savings in construction costs (based on Alternative 1) could also be expected if the Stage 1 interchange design was revised.

This memo (and scroll plot exhibits) documents the changes to be made to the approved Stage 1 design of the subject project as a result of the above VE studies and a subsequent review meeting by ODOT District 9, ODOT ORE, ODOT OGE, and FHWA on April 23, 2009. The proposed changes agreed to at the meeting and documented herein are estimated to save approximately \$5 million in construction costs without adversely affecting the safety and operation of the facility. These changes and any final adjustments will be incorporated into the Stage 2 plans; a summary of the major changes are detailed below (see attached exhibits for detailed profiles and interchange plans).

- > SR 823 profile modified from Station 387+00 to 543+55:
 - Steepened and raised the profile grade from +1.5% to +2.9% from Stations 387+00 to 422+00.
 - Shifted VPIs to raise the profile from Stations 442+00 to 470+20; flattened ahead grade to +1.5% from +2.6%.
 - Shifted VPIs to raise the profile from Stations 489+40 to 536+55; slightly steepened grade approaching CR 28 from -2.90% to -2.99%.
 - Tied back to Stage 1 (Phase 2) profile elevation at Station 543+55 with ahead grade of +4.00%.
 - All vertical curves meet the 70 mph design speed; Stage 1 maximum 4.5% grades were maintained.
- > Modified TR 234 Ramp A profile
 - Shifted VPIs to raise the profile; steepened predominant grade to +4.97 from +4.88; set tie-in grade at +2.9% to match the SR 823 grade.
- > Modified TR 234 Ramp D profile
 - Adjusted VPIs to raise the profile; steepened predominant grade to +2.80% from +1.91%; set the tie-in grade at +3.40% to match the elevations controlled by the SR 823 grade.
- > Modified acceleration length for TR 234 Ramp A. Provided an auxiliary lane from Station 409+50 to 420+00 (high point of SR 823); utilized a 50:1 taper to Station 426+00 to drop the lane. This change is required to mitigate the reduction of truck speeds due to the modified profiles.
- > Modified CR 28 Interchange by shifting the interchange/ramps to the north approximately 300 ft.
 - New horizontal and vertical geometry for all ramps due to revised location; overall configuration remains the same.
 - Maintained or improved Stage 1 degree of curves.
 - Ramp A profile features a -5.97% max grade, Ramp B +5.87%; all others less than 4.3% and similar to Stage 1.
- > Bridges over Swauger Valley Road and SR 139 to be revised to meet the profile changes.

Subject: Profile and Interchange Modifications for Stage 2

Project: Portsmouth Bypass Phase 1

Project No: SCI-823-6.81, PID 19415

Meeting Date: April 23, 2009

Meeting Location: ODOT Central Office

Notes by: Lori Dearnell

Attendees:

Tom Barnitz, ODOT D9
Rick Bruce, ODOT ORE
Steve Taliaferro, ODOT OGE
Chris Merklin, ODOT OGE
Adam Johnson, FHWA
Brad Hyre, HDR
Doug Voegelé, HDR
Jim Breitinger, HDR
Lori Dearnell, HDR

Topics Discussed:

1. HDR explained how the VE Session in December 2007 led to a study of the SR 823 Stage 1 profile, which led to ODOT authorizing modifications to the mainline profile, as shown as profile VE-7 of the study. As part of the authorization, ODOT directed HDR to make minor modifications to the VE-7 profile to further reduce the required excavation and associated waste. At this time, HDR has made final proposed revisions to the profile, which is now presented as Proposed Profile (Stage 2).
2. The Proposed Profile (Stage 2) modifications were described. HDR explained that the major change in the profile was to relocate the VE-7 PVI from Station 402+00 to Station 392+00. This PVI relocation allowed the profile to reach a higher elevation at the first rock cut (cut #11) without steepening the approximately 2.9% grade used in VE-7. The elevation difference reduced the excavation and increased the embankment required, resulting in reduced waste and an additional cost savings of approximately \$0.6 million over the VE-7 profile, for a total savings of \$3.1 million.
3. The earthwork through the rock cut areas was generated by using a simplified cut slope which was calibrated against the Stage 1 quantities. Since the earthwork represented 100% of the savings, HDR hand edited cross sections to the final cut configuration through cut 11 at approximately 200 ft intervals and calculated volumes with these sections as a check to ensure that the volumes reported by the simplified slopes were representative of the likely volumes calculated after final sections are created. The checked volumes essentially matched those with the simplified cut slope. In response to a question, HDR noted that a reduction in wick drain spacing to account for the higher embankments was figured into the cost savings. The only other revision to the VE-7 profile was a minor adjustment in the area of the SR 139 bridge to help reduce impacts to that structure.

4. The mainline profile modification increased the elevation at the TR 234 Ramps A and D tie-in points by approximately 15 ft over the Stage 1 profile, so the ramp profiles also required modification. HDR indicated that Ramp A (northbound entrance ramp) was the critical ramp since TR 234 is lower at the ramp intersection than it is at the Ramp D intersection. The grade on this ramp would increase from 4.88% (Stage 1) to 4.97%.
5. ODOT offered comments on the Proposed Profile (Stage 2) and the TR 234 Ramp A profile. Mr. Bruce indicated that under the Stage 1 profile, northbound truck speeds at the gore would be 35 mph and at the crest of the first hill the truck speeds would be reduced to 45 mph. Under the Proposed Profile (Stage 2), the northbound truck speeds would reduce to 29 mph at the gore and 35 mph at the crest of the first hill. Mr. Bruce stated that this represents a big differential in truck speed and cars traveling 65 mph. ODOT typically uses a maximum speed reduction for trucks of 10 mph; however, this criteria technically applies to a 2-lane roadway.
6. All attendees agreed that it would be a good idea to extend an auxiliary lane from Ramp A to the crest of the hill to provide more separation between slow traveling trucks and faster moving vehicles. All attendees agreed that Proposed Profile (Stage 2) was approved as shown with the added auxiliary lane extension and HDR could proceed with the Stage 2 design based on this new profile.
7. HDR presented the findings of the CR 28 interchange study, which examined changes to the proposed interchange design that could significantly reduce the amount of excavation. The study included three alternatives: 1) same interchange configuration as Stage 1 but moved approximately 300 ft closer to CR 28; 2A) relocate CR 28 approximately 200 ft to the south and use a diamond style interchange; and 2B) place a diamond style interchange at CR 28 without relocating CR 28. All three alternatives provided a cost savings over the Stage 1 plans with the diamond style interchange at relocated CR 28 providing the largest savings. However, the ramp grades required north of CR 28 for this alternative were less than desirable at nearly 8%. ODOT agreed that both of the diamond style alternatives featured unacceptable grades and therefore, would not be approved by ODOT.
8. Alternative 1 (shift the current configuration 300 ft north) featured ramps with 6% or less grades and had no adverse impact to the safety and operation of the facility. The only negative impacts included with Alternative 1 were the bridge over CR 28 needed to be wider than the Stage 1 design and the new ramp locations required more wick drains than the Stage 1 plans. Both of these costs were factored into the estimated cost savings of \$1.7 million for changing the plans to Alternative 1. All attendees agreed that Alternative 1 was preferred and should be incorporated into the Stage 2 design.

The following is a summary of the information agreed upon by all parties:

- Proceed with the Proposed Profile (Stage 2) as presented.
- Proceed with the revised TR 234 Ramp A and D profiles as presented.
- Provide an auxiliary lane from TR 234 Ramp A to the crest of the first hill, from Station 409+50 to 420+00 (high point of SR 823) and drop the auxiliary lane with a 50:1 taper. Signing to be provided to indicate that the lane is ending.
- Proceed with the revised CR 28 Interchange (Alternative 1) as presented. *Subsequent to the meeting, Rick Bruce requested that the presented horizontal curves be revised so that degree of curve conforms to the superelevation tables (not radius), and that the superelevation rate be provided with the curve data. HDR will incorporate these changes into the Stage 2 plans.*
- Additional borings may be required for the new geometry of CR 28 Ramps B and C. OGE will discuss the need for these additional borings internally and respond back to HDR. If OGE determines that additional borings are required, ODOT will drill the borings using their own crews.

To: Tom Barnitz, PE, ODOT D9	
From: Brad Hyre, PE, HDR	Project: SCI-823-6.81; PID 19415
CC: Rick Bruce, ODOT ORE; Adam Johnson, FHWA	
Date: April 14, 2009	Job No: 45878

**RE: SCI-823-6.81
PID No. 19415
Portsmouth Bypass Phase 1
Proposed Profile Modification**

A second Value Engineering (VE) Session for the entire Portsmouth Bypass project was held by ODOT in December 2007. This review was based on Stage 1 plans for Phase 1. One of the alternatives generated by this VE Session was Alternative 2/30: *Adjust the profile to reduce the volume of excavation and waste material by allowing high fill culverts.* In September 2008, ODOT authorized HDR to study Alternative 2/30 to determine if there was merit to revising the profile in Phase 1 of the project so as to reduce the project's construction costs.

In December 2008, HDR submitted a final Value Engineering Studies report which presented the findings of HDR's study. During the study, the following parameters were used to develop several modified profiles for evaluation:

- Design Speed of SR 823 is 70 mph
- Set reduction of excavation as the target
- Minimize the bridge impacts, but investigate options with and without bridge impacts
- Minimize additional project footprint
- Use a maximum grade of 4.5% on SR 823 (maximum used in Phase 1 Stage 1 plans)
- The profile could be changed in key areas or throughout the complete Phase 1 limits
- The maximum grade on any ramp is to be 6%

Two proposed VE profiles were submitted to ODOT for consideration in the December report. The primary difference between the two being in the area of the TR 234 interchange. Of the two, conceptual profile VE-7 provided the largest cost savings with the least negative impact in the area of this interchange, in particular the profile grades in the gore area of the mainline and northside ramps. This profile increased the Stage 1 mainline grade between Stations 397+00 and 424+00 from a +1.5% to a +2.9% and thereby raised the profile approximately 20 ft through the first major cut area. The VE-7 profile also raised the grade approximately 10-15 ft through the additional cut areas within the Phase 1 limits by raising and shifting the PVI's. The net cost savings associated with this conceptual profile change, as documented in the December report, was estimated to be approximately \$2.5 million.

Upon review of the study, ODOT directed HDR to revise the profile for Phase 1 to a refined version of the VE-7 profile, with the intent to reduce as much excavation and waste as possible, as well as reducing haul distances along the project. HDR was authorized to start this work on March 26, 2009. This memo (and associated scroll plot) documents the changes made from the VE-7 profile with the proposed Stage 2 profile.

The refinement of the VE-7 profile for Stage 2 focused primarily on the area north of TR 234 (Station 385+00 to 435+00), including the first mainline cut north of the interchange. Adjustment of the embankment and excavation through this area could provide additional cost savings as well as potentially provide a nearly balanced earthwork for the work area from the start of Phase 1 to Swauger Valley Road (Station 443+00). This could eliminate the need to cross Swauger Valley Road with material during construction. The proposed profile in the vicinity of the SR 139 Portsmouth-Minford Road Bridge (Station 485+00) was also re-evaluated in an attempt to avoid lengthening the end span on the proposed bridge, as well as keeping the modified profile near or above the Stage 1 profile in the area of the proposed noise wall (Station 481+00 to 508+00); this would maintain the noise wall design (heights) as presently proposed.

During the profile refinement process near TR 234, it was determined that the PVI of the proposed 2.9% grade could be shifted from Station 402+00 (with VE-7) to Station 392+00 without adversely affecting the TR 234 ramp profiles (grades for the ramps remain under 5%). This 1000 ft shift allows the project to use more fill material between Stations 387+00 and 416+00 and also further reduces the excavation in the first major cut area (Stations 416+00 to 434+00). In the vicinity of the Portsmouth-Minford Road Bridge, it was determined that moving the VE-7 PVIs improved and/or maintained the bridge and noise wall design without significantly impacting the cut and fill volumes between the PVI's. The remainder of the proposed Stage 2 profile matches the VE-7 profile.

All of the vertical curves on the proposed Stage 2 profile meet the 70 mph design speed ($K=247$ for crest curves and $K=181$ for sag curves) and all of the grades are at or less than the 4.5% maximum used in the Stage 1 Phase 1 plans (mainline grades in Phase 3 reach 5%). Lengthening the 2.9% grade between Station 392+00 and Station 422+00 near TR 234 resulted in the area from the beginning of Phase 1 to Swauger Valley Road (Station 443+00) becoming essentially balanced between excavation and embankment volumes. This longer grade will slightly reduce the mainline truck travel speed when compared to the VE-7 profile; however the proposed grade and length fits the character of the overall project through the mountainous terrain while providing project cost savings. Steeper grades and longer lengths are used for the southbound climb away from the US 23 interchange in Phase 2, as well as the northbound climb away from the SR 140 interchange in Phase 3.

With the TR 234 interchange design, the critical ramp profile impacted by a mainline profile change is Ramp A, the northbound entrance ramp. The Stage 1 design used a maximum grade of +4.88% with a length of 1150 ft between PVIs. Since the proposed Stage 2 profile raises the mainline approximately 15 ft in the area of the ramp gore (above Stage 1), the proposed Ramp A profile utilizes a +4.97% grade (with 1450 ft between PVIs) to make up this elevation difference. The entrance ramp has an acceleration length of 1000 ft which provides enough acceleration distance for the ramp vehicle to be traveling 40 to 45 mph and accelerate to 70 mph. Along the mainline, while the grade is increased from the Stage 1 plans (+1.5% to +2.9%), the highpoint of the crest vertical curve at the top of the grade is reached approximately 550 ft sooner, reducing the length of grade.

Impacts from the higher embankment height north of TR 234 include the lengthening of two culverts (standard design) to accommodate the higher fill and slight adjustments with the overall construction limits. By adjusting fill slopes, minimal changes are expected with the fill limits outside the culvert locations. Wick drain spacing for settlement in the interchange area will be similar to that proposed with VE-7.

In the area of the SR 139 crossing, the change from the VE-7 to proposed Stage 2 profile is minimal (less than 5 ft), with no additional impacts anticipated. The noise wall design parameters in this area can remain as proposed.

Portsmouth Bypass Phase 1
Proposed Profile Modification

Table: Additional Mainline/Ramp Savings

Item	VE-7	Proposed Stage 2	Difference	Unit Cost	Savings
Excavation	4,498,000	4,387,000	111,000	\$3.35	\$372,000
Waste	1,569,000	1,048,000	521,000	\$1.10	\$573,000
Total Additional Savings					\$945,000

Table: Additional Mainline/Ramp Cost

Item	VE-7	Proposed Stage 2	Difference	Unit Cost	Cost
Embankment	3,604,000	3,998,000	394,000	\$0.74	\$292,000
78" Culvert			54	\$288.00	\$15,552
72" Culvert			58	\$205.00	\$11,890
Stream Mitigation			112	\$250.00	\$28,000
Total Additional Cost					\$348,000

The proposed Stage 2 profile represents an additional estimated \$0.6 million savings above the \$2.5 million net savings estimated for VE-7, with minimal negative impacts. Overall, the proposed Stage 2 profile should provide ODOT an estimated \$3.1 million savings in project costs over the Stage 1 profile.

Table: Earthwork By Project Section (includes side roads)

	Stage1		
	*Cut	Fill	Delta
Start to Swauger Valley	2,591,950	1,601,750	990,200
Swauger Valley to SR139	510,600	1,012,000	-501,400
SR139 to CR28	3,587,300	689,500	2,897,800
Total	6,689,850	3,303,250	3,386,600

	VE-7		
	*Cut	Fill	Delta
Start to Swauger Valley	2,319,350	1,731,650	587,700
Swauger Valley to SR139	377,200	1,157,000	-779,800
SR139 to CR28	3,019,900	789,550	2,230,350
Total	5,716,450	3,678,200	2,038,250

	Proposed Stage 2		
	*Cut	Fill	Delta
Start to Swauger Valley	2,192,000	2,126,500	65,500
Swauger Valley to SR139**	377,200	1,157,000	-779,800
SR139 to CR28**	3,019,900	789,550	2,230,350
Total	5,589,100	4,073,050	1,516,050

*Cut with 15% swell factor applied (payment is based on raw excavation)

**Overall change in cut/fill between VE-7 and Proposed Stage 2 in these areas is minimal and was not recalculated for this memo.