

Memo

To: Anthony Haverly, PE

From: David Beardsley, PE
Young Kim, PE
Jimmy Stewart, PE

Date: February 27, 2019

Re: UPC 113323 Fairground Road Extension PFI Concept Alignments – REVISED VERSION 2

The purpose of this memorandum is to summarize four (4) conceptual alignments being evaluated for the Fairground Road Extension project between Sandy Hook Road (US Route 522) and River Road (VA Route 6). As part of this effort, ATCS evaluated one roadway alignment that was proposed in previous conceptual sketches developed by others, as well as two additional alignment alternatives. Additionally, Goochland County requested the evaluation of an additional alternative that is called the “County Alternative” in this document. These alignments are illustrated in the attached exhibits. The design criteria for Fairground Road Extension and for River Road are presented in Table 2.

Additionally, order-of-magnitude costs were developed to compare the alternatives, and the details are provided in the attached cost spreadsheet. It should be noted that the costs developed for this spreadsheet are intended for comparison purposes only and are not intended to represent PFI-level cost estimates for the project. A more detailed cost estimate will be developed using more detailed design information once an alignment alternative is selected.

The following is a list of various advantages and disadvantages for each alternative:

Alternative 1 (Based on original Concept Sketch from Kittelson)

Length - 1,085 feet

Cost ~ \$2.8 million

Advantages:

- Runs parallel to R/W line and balances property impacts on both sides of the road
- Same as the original concept sketch developed for the road

Disadvantages:

- An uneconomical remnant of land is left on the east/south side of the impacted parcel
- The proposed new intersection with River Road is not at a 90-degree angle, decreasing sight angles for stopped motorists on Fairground Road Extension, and causing potential undesirable effects for turning traffic from River Road such as right-turns encroaching on oncoming travel lanes and left-turning traffic potentially traveling at higher than normal turning speeds

- The new intersection is in close proximity (375 ft) to an existing entrance on the south side of River Road and the roadway widening required to provide a left-turn lane on River Road would impact that existing driveway. The driveway currently intersects River Road at a steep grade (approximately 14%) and any geometric modification to River Road at the intersection with that driveway may require additional improvements to prevent the driveway grades from steepening further and would generate additional project costs
- The distance between the new intersection and the adjacent access point does not meet access management standards of 470 feet on River Road for a minor arterial. As noted in Appendix F of the VDOT Roadway Design Manual, the purpose of meeting the minimum access spacing standards is to maintain the capacity and safety of the highway (River Road).

Alternative 2 (Original Alignment with 90-degree Intersection)

Length - 1,080 feet

Cost ~ \$3.1 million

Advantages:

- Fairground Road Extension intersects River Road at a 90-degree angle, providing improved sight angles and potential benefits in the operational deficiencies noted for Alternative 1
- Provides the shortest length of roadway among the 3 alternatives by 5 feet

Disadvantages:

- Due to limitation related to wetland and stream features on the properties to the east of the new road alignment and north of River Road, the remaining land may have limited development opportunities
- The new intersection is in close proximity (305 ft) to an existing entrance on the south side of River Road and the roadway widening required to provide a left-turn lane on River Road would impact that existing driveway
- The distance between the new intersection and the adjacent access point does not meet access management standards of 470 feet on River Road for a minor arterial. As noted in Appendix F of the VDOT Roadway Design Manual, the purpose of meeting the minimum access spacing standards is to maintain the capacity and safety of the highway (River Road).
- More excavation than Alternative 1 by 1,300 CY due to topography and is therefore more costly

Alternative 3 (Northern Alignment)

Length - 1,160 feet

Cost ~ \$ 2.9 million

Advantages:

- Provides increased intersection sight distances over Alternatives 1 and 2 because the intersection is closer to the center of the horizontal curve on River Road (see Table 1 for observed sight distances) and is not obstructed by trees on the south side of River Road. Per NCHRP 875, an increase in available sight distance from 565' to 860' can reduce fatal and injury crashes by approximately 10%. See chart A-3 for reference.
- Provides more direct access to northern parcels than the other Alternatives
- Provides greater development space on the east/south side of the Fairground Road Extension than the other 2 alternatives
- Does not meet access management standards on River Road, but is only short of the standard by 28 feet
- Less excavation than Alternative 2 by 1,040 CY

Disadvantages:

- At the proposed intersection location, River Road has a superelevation of 7.5% and creates the need for a grade break between 6 and 7 percent within the intersection
- Longer than Alternative 2 by 80 feet, costing more for pavement, curb and gutter and sidewalk items

County Alternative

Length - 955 feet

Cost ~ \$ 3.4 million (not inclusive of right-of-way costs)

Advantages:

- Aligns new roadway further to the east/south in order to provide more developable property on the western portion of the impacted parcels/properties.
- The new proposed intersection meets sight-distance and access management requirements.
- Length of new alignment is shorter than other alternatives by 145 feet.

Disadvantages:

- Additional survey is needed in order to complete the design for this concept, as shown on the alternative concept plan.
- This alternative is estimated to require approximately 46,845 more cubic yards of excavation than Alternative 3, but 46,755 less cubic yards than Alternative 2. It should be noted that this is a rough estimate, as topographic survey is not available for a portion of the alignment. This can be refined if new survey information is obtained.
- The existing culvert under River Road just east of the mobile home community driveway will need to be extended and replaced due to the road widening impacts at that location. This impact is not present for the other alternatives, as the road widening for left-turn lanes on River Road occurs the furthest east under this alternative.
- The road widening will result in an impact on the mobile home community driveway and require approximately 165 linear feet of regrading and replacement of pavement in order to correct achieve acceptable grades and sight distances on the driveway. This will result in potentially requiring additional right-of-way or construction easements, creating additional risks to the project schedule and cost.
- The widening of River Road to the east of the mobile home community driveway will require the replacement of the substandard guardrail on both the north and south sides of River Road (east of the mobile home community driveway).
- The widening of River Road causes a shortening of the queueing space and distances between the adjacent intersections internal to the mobile home community and causes traffic operations/queueing concerns that may result in blocking traffic turning from River Road into the mobile home community. Additional design modifications are likely needed to correct this issue that would require additional impacts to the mobile home community property that are not shown as part of this concept.

TABLE 1 – Observed Intersection Sight Distances

Alternative	Observed Intersection Sight Distance*	
	SDL	SDR
1	>1000'	~565'
2	>1000'	~585'
3	~860'	>1000'
4 (SB)	>1000'	>1000'
4 (NB)	~800'	~565'

* Distances are based on field measurements and are approximate

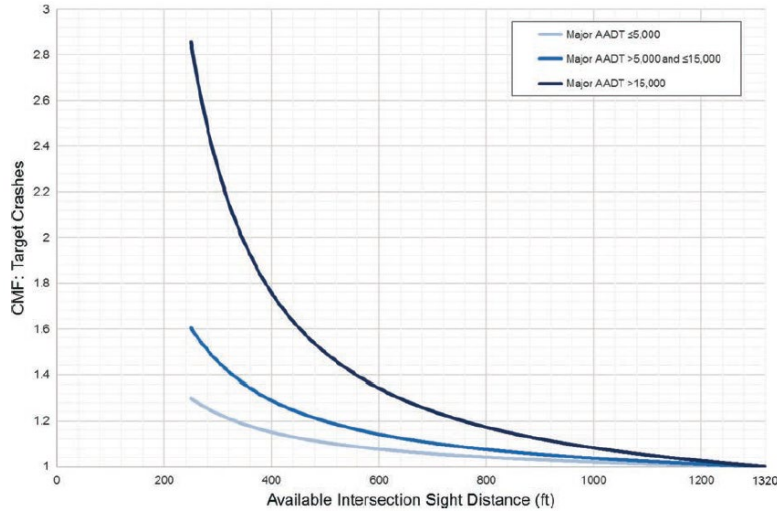


Chart A-3. CMFs for target crashes when posted speed equals 45 mph.

TABLE 2 - Design Criteria Table

Fairground Road Extension (Rte. 632) – Goochland County, VA
VDOT Project No. 0632-037-R83, P101, RW201, C501 – UPC 113323

Design Parameter	RT 632 (Fairground Rd. Ext.)	Route 6 (River Rd.)	Reference Source* (AASHTO)	Reference Source* (VDOT)
VDOT Geometric Standard/Functional Classification	GS-6 (Urban Minor Arterial)	GS-2 (Rural Minor Arterial)		RDM Pg. A-13, A-17
Current ADT (2017)	New Road (6,200 east of Rte. 522 Sandy Hook Rd)	6,000		VDOT AADT Data
Design ADT (2043)	8,200	8,200		
Min. Design Speed (mph)	35	45		RDM Pg. A-4
Terrain	Rolling	Rolling	AASHTO Pg. 7-29	
Design Vehicle	WB-62	WB-62		
Min. Horizontal Radius (ft.)	373	589		RDM Pg. A-13, A-17
Intersection Sight Distance (ft.)				
SDL – 2 Lane (ft.)	390'	500'		RDM Pg. F-40
SDR – 3 Lane (ft.)	440'	565'		RDM Pg. F-40
Min. Stopping Sight Distance (ft.)	250	360		RDM Pg. A-13, A-17
Min. Crest K Value	29	61	AASHTO Pg. 3-155	
Min. Sag K Value	49	79	AASHTO Pg. 3-161	
Min. Lane Width (ft.)	11	12		RDM Pg. A-13, A-17
Std. Curb and Gutter	CG-6	n/a		RDM Pg. A-13, A-17
Std. Curb Median	CG-2	n/a		
Min. TOTAL Shoulder Width (ft.) – FILL WITH GR / CUT & FILL (NO GR)	14' / 10'	14' / 10'		RDM Pg. A-13, A-17

Design Parameter	RT 632 (Fairground Rd. Ext.)	Route 6 (River Rd.)	Reference Source* (AASHTO)	Reference Source* (VDOT)
Min. PAVED Shoulder Width (ft.) – LT/RT				
Buffer Strip Width (ft.)	LT 4' / RT 8'	LT 4' / RT 8'		RDM Pg. A-13, A-17
Min. Sidewalk Width (ft.)	4	Behind roadway ditch		RDM Pg. A(1)-23 RDM Pg. A(1)-69
Superelevation Std.	5	5		RDM Pg. A(1)-71
Max. Superelevation (%)	TC-5.11U	TC-5.11R		RDM Pg. A-13, A-17
Max. Grade (%)	4	8	R&B Section 800	
Min. Grade (%)	8	7	AASHTO Pg. 7-29	
MINIMUM SPACING STANDARDS	0.3 (0.5 desirable)	0.3 (0.5 desirable)	AASHTO Pg. 7-28	
Signalized to Signalized (ft.)				
Unsignalized/Partial to Unsignalized/Partial (ft.)	1,050	1,050		RDM Pg. F-26
Full Access/Partial to Partial Access (ft.)	660	660		RDM Pg. F-26
Spacing from Full Access/Partial/One Way to Any Access (ft.)	470	470**		RDM Pg. F-26
Clear Zone (ft.)	250	250		RDM Pg. F-26
Min. Lateral Offset (ft.)	14 – 16	20 – 22		RDM Pg. A-28
IIM 227.9 (Design Exceptions/Waivers)	1.5 beyond the face of curb 3 at intersections/driveways	Use Clear Zone		RDM Pg. A-26 RDM Pg. A-27
TAPER LENGTHS	TBD	TBD		IIM-227-11
Transition/merging taper				
TRANSITION taper	$L = Wx(S^2)/60$	$(\%)L = (3/4)WxS$		RDM Pg. F-60
Min. LEFT turn lane taper	245'	405'		RDM Pg. F-60
Min. LTL storage length	100'	200'		RDM Pg. F-55
Min. RTL turn lane taper	100'	100'		RDM Pg. F-55
Min. RTL storage taper	N/A	N/A		RDM Pg. F-55
	N/A	N/A		RDM Pg. F-55

* List of References:

- o VDOT Road Design Manual, Rev. July, 2018
- o 2011 AASHTO Green Book 6th Edition

** Alternative 1 Intersection Spacing: The proposed Route 632 (Fairground Road extension) intersection with Route 6 is located 375' west of an existing full-access entrance on the south side of Route 6.

Alternative 2 Intersection Spacing: The proposed Route 632 (Fairground Road extension) intersection with Route 6 is located 305' west of an existing full-access entrance on the south side of Route 6.

Alternative 3 Intersection Spacing: The proposed Route 632 (Fairground Road extension) intersection with Route 6 is located 442' west of an existing full access entrance on the south side of Route 6.

Alternative 4 Intersection Spacing: The closest existing entrance to the proposed intersection is located 560 feet to the east.



**ALTERNATIVES COST COMPARISON
FAIRGROUNDS ROAD EXTENSION DESIGN
GOOCHLAND COUNTY, VIRGINIA**
VDOT Project No. 0632-037-R83
UPC No. 113323

Prepared By:



Code	Description	Unit	Unit Price	Alternative 1		Alternative 2		Alternative 3		County Alternative	
				Qty	Total	Qty	Total	Qty	Total	Qty	Total
Grading Items											
00100	Mobilization	LS	Formula	1	\$ 111,600	1	\$ 121,100	1	\$ 114,700	1	\$ 129,000
00101	Construction Surveying	LS	Formula	1	\$ 16,400	1	\$ 18,300	1	\$ 17,000	1	\$ 19,800
00120	Regular Excavation	CY	\$ 90	3,210	\$ 288,900	4,510	\$ 405,900	3,470	\$ 312,300	3,991	\$ 359,145
Pavement Items											
10128	Aggr. Base Matl. Ty 1 No.21B	TON	\$ 45	2,104	\$ 94,680	2,125	\$ 95,625	2,250	\$ 101,250	2,025	\$ 91,125
10607	Asphalt Concrete Ty. SM-12.5A	TON	\$ 75	801	\$ 60,075	807	\$ 60,525	834	\$ 62,550	751	\$ 56,295
10610	Asphalt Concrete Ty. IM-19.0A	TON	\$ 115	630	\$ 72,450	636	\$ 73,140	655	\$ 75,325	590	\$ 67,793
10625	Flex. Pave. Tie-in Planing 0"-2"	SY	\$ 25	3,198	\$ 79,950	3,209	\$ 80,225	3,179	\$ 79,475	2,861	\$ 71,528
10642	Asphalt Concrete Ty. BM-25.0A	TON	\$ 85	859	\$ 73,015	868	\$ 73,780	894	\$ 75,990	805	\$ 68,391
11070	NS Saw Cut Asph. Conc. Pavement	LF	\$ 5	2,670	\$ 13,350	2,680	\$ 13,400	2,153	\$ 10,765	2,450	\$ 12,250
Incidental Items											
12600	Std. Comb. Curb & Gutter CG-6	LF	\$ 45	1,010	\$ 45,450	849	\$ 38,205	2,161	\$ 97,245	2,053	\$ 92,383
12610	Rad. Comb. Curb & Gutter CG-6	LF	\$ 45	1,172	\$ 52,740	1,338	\$ 60,210	186	\$ 8,370	177	\$ 7,952
13220	Hydraulic Cement Conc. Sidewalk 4" (Class A3)	SY	\$ 70	578	\$ 40,460	585	\$ 40,950	621	\$ 43,470	590	\$ 41,297
13280	Guardrail GR-MGS1	LF	\$ 20	-	-	-	-	-	-	1,600	\$ 32,000
13286	Guardrail CG-MGS2	EA	\$ 3,000	-	-	-	-	-	-	4	\$ 12,000
**	Drainage Items (20%)	20%			\$ 164,300		\$ 188,400		\$ 173,400		\$ 347,300
*	Storm Water Management (see note 3)	LS			\$ 300,000		\$ 300,000		\$ 300,000		\$ 360,000
	Environmental - Wetlands Mitigation (PFO)	LS			\$ 17,100		\$ 13,500		\$ 6,300		\$ 12,600
	TMP/MOT Items (5%)	5%			\$ 41,100		\$ 47,100		\$ 43,400		\$ 43,500
	Erosion Control Items (15%)	15%			\$ 123,200		\$ 141,300		\$ 130,100		\$ 130,300
	Signing and Pave. Marking Items (5%)	5%			\$ 41,100		\$ 47,100		\$ 43,400		\$ 43,500
	Utility Relocations (15%)	15%			\$ 123,200		\$ 141,300		\$ 130,100		\$ 130,300
	Sub-Total				\$ 1,759,070		\$ 1,960,060		\$ 1,825,140		\$ 2,128,457
	C.E.I	20%			\$ 351,900		\$ 392,100		\$ 365,100		\$ 425,700
	Construction Contingency	40%			\$ 703,700		\$ 784,100		\$ 730,100		\$ 851,400
	Total				\$ 2,814,670.00		\$ 3,136,260.00		\$ 2,920,340.00		\$ 3,405,556.75

Notes: 1. Unit Prices Taken from VDOT District Averages through June 2018 and VDOT Two Year Historical Bid History though August 2018

<http://www.virginia.gov/business/resources/const/DistrictAverages.pdf>
<http://www.virginia.gov/business/resources/const/2yearhistory.pdf>

2. Mobilization and Construction Surveying calculated using VDOT PRECON equations

* 3. Preliminary cost includes: \$100,000 Nutrient credit purchase, and \$200,000 for proposed "take" size (quantity). Assumed extended detention Level I

4. Cost estimate does not include Right of Way

** 5. Assumed closed drainage system with curb and gutter. County Alternative used 40% to account for two (2) 36" culvert replacement under River Rd. (Sta. 118+50 and Sta. 121+50)