

# **PERRY PARK SECONDARY ACCESS ADVISORY COMMITTEE**

## **ENGINEERING/ENVIRONMENTAL ISSUES SUBCOMMITTEE**

### **Subcommittee Members**

Darrell Roberts  
Don Korinek

### **Task**

Determine the proposed route that will:

- |    |   |        |
|----|---|--------|
| A. | Be the easiest to design  | Wt. 10 |
| B. | Provide the least amount of environmental impact along with the lowest amount of mitigation in an adjacent area | Wt. 6  |
| C. | Provide for ease of construction and within a reasonable timeframe  | Wt. 4  |

### **Resources**

- A. Darrell E. Roberts, P.L.S. – Douglas County
- B. Don Korinek
- C. Corey Lang – TranSystems Corporation
- D. Douglas County Roadway Design and Construction Standards
- E. Colorado Department of Transportation, Standard Specifications for Road and Bridge Construction, 1999 and as amended
- F. Colorado Department of Transportation, Standard Plans, M & S Standards, Oct. 2000
- G. American Association of State Highway and Transportation, A Policy on Geometric Design of Highways and Streets (The Green Book)

The “American Association of State Highway and Transportation Officials” manual addresses the design requirements of a “Local Collector” as follows: “In all cases every effort should be made to get the best possible alignment, grade, sight distance, and proper drainage that are consistent with the terrain, present and proposed development, and available funds.”

**Design Difficulty**

There are several factors that will affect the degree of difficulty associated with designing a roadway. The following issues were discussed during the first committee meeting/training session and need to be considered:

<b>Issue</b>	<b>Weight</b>
Roadway Alignment	10
Grade	10
Site Distance	8
Hydraulic Analysis	6
Survey (Design & Legal Descriptions)	2
Geotechnical Investigation	2
Pavement Design	2

**Roadway Alignment**

In review of all proposed routes, it has been determined that all routes can be designed to meet the current Douglas County Design and Construction Standards. There are several issues associated with designing the alignments for the routes. Horizontal alignments generally are reviewed for the following items: Proposed speed limit, clear zones – impact zones, volume, length, number of intersections along the alignment from top to bottom (from a local road start to a tie in with either another collector or arterial), and site distances.

Findings: The issues associated with the roadway alignment of Route 3 would be the easiest to deal with. The route is straight with only two major changes in direction resulting in two large curves. Route 4 would be the second easiest base on the fact that it would be the shortest in length and would follow then existing right-of-way for a majority of the length. There are some alignment issues that would need to be addressed on Perry Park Road (County Road 105). Route 6 would follow Route 4 due mainly to the same issues with Route 4, however the length of improvements on Perry Park Road would be twice as long. Route 7 is next due to the fact that it is also somewhat straight and the improvements to Perry Park Road would mirror Route 6, however the alignment across West Plum Creek is more difficult to deal with due to two curves in this area. Improvements to the existing roadway (Echo Village Rd.) need to be laid out as well. Route 5 would be the second hardest alignment due to the overall length, the tie-in on the west end needs to match into the existing right-of-way and has several curves on this end. Route 2 will be the hardest to lay out horizontally due to the length, large number of curves, creation of a new intersection on the west end of the alignment, and a parallel alignment next to a drainage way.

	<b>Alternative Route</b>					
<b>Issues</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
Roadway Alignment - Score	0	10	8	2	6	4

**Grade**

Vertical alignments must be designed in conjunction with the horizontal alignment. Both alignments must complement each other to provide the safety, capacity, and appearance for the type of improvement proposed.

Findings: Once again Route 3 would be the easiest route to design in reference to grade issues. This route would fit right on top of the existing ground with very little change in the grade needed. Route 4 would then be the next route that will be closest to matching the existing topography. Route 7 places third due to grade issues associated with squeezing in the route as close as possible to the ridge on the south side of this alignment and then addressing grade issues along County Road 105. Route 6 is very similar to Route 7 and would appear to be easier to fit into the existing grades especially along the west end of the route. This is true, however in the area adjacent to the existing barn, the vertical grade issues result in the use of major retaining walls to complete the design thus lowering the score for this route. Route 2 will be the second hardest to fit into a proper grade due mainly to the terrain halfway through the route heading west and then proceeding along the east side of the sewage treatment plant to the tie-in on Perry Park Blvd. Route 5 scores the lowest because like Route 2 will fit into the existing terrain until reaching the top of the hills just west of West Plum Creek. At that point the terrain becomes very hilly until reaching the west side of Bear Creek. The grades are relatively flat for approximately 1/2 mile and then once again become very hilly until reaching the tie-in with Country Club Drive (proposed).

	<b>Alternative Route</b>					
<b>Issues</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
Roadway Grade - Score	2	10	8	0	4	6

**Site Distance**

Minimum stopping sight distance and passing sight distance are a direct function of the design speed. Sight distance is also a requirement based on the number of intersections or access point to the roadway.

Findings: Route 3 comes out on top with only one major curve on the east end that will have some site distance issues. The intersection with CR 105 is skewed however at the proposed stop line, site distance in each direction is very good. Route 7 comes in second basically due to limited number of access points and the proposed roadway matching the existing grade at the intersections. Route 4 and 6 place third and fourth respectfully simply due to a slow speed limit throughout it's length in a residential area results in a lower site distance requirement. Route 5 comes in second to last, while there is good site distance on the eastern half of the route, the hills on the west end along with the tie-in to the residential area with intersections hold this alignment back. Last would be Route 2, while it has a limited number of accesses, curves along the route both horizontally and vertically reduce the score.

	Alternative Route					
Issues	2	3	4	5	6	7
Site Distance - Score	0	10	6	2	4	8

### **Hydraulic Analysis**

An analysis of each drainage basin associated with each route will be required. Some of the proposed routes have more than one drainage basin along the alignment. The direction of the drainage at the crossing and amount of improvements in the channel will be key factors that will add to the difficulty in design of the project. In addition to the major drainage crossings, sizing of culverts in smaller drainage basins is also required.

Findings: Route 4 would be the easiest to design as the drainage channel is fairly straight through the bridge opening and there is one culvert on CR 105 that would be a factor. The west end of the route would tie into Perry Park Blvd. with the need for a culvert as well. Route 6 is close behind Route 4 with the drainage channel at a similar angle under the bridge, two culverts along CR 105 would need work along with a culvert at the west end of the route (the same at Route 4). Route 7 would be next as it is very similar to Route 6, however the channel under this bridge is somewhat more skewed requiring a little more work in the design and construction phase. The culverts on CR 105 are the same as Route 6, the upgrade to the existing roadway on the west end of this route would require some revised drainage calculations. Route 3 would also require revised drainage calculations at each end of the route and the drainage crossing under the bridge is skewed the most with this route making it the third hardest route in reference to hydraulic analysis. Route 2 crosses one major drainage channel and the skew is minimal, however this route has several cross culvert locations requiring addition study along with a portion of the route parallel to Bear Creek. Route 5 comes in last due mainly to the fact that it crosses two major drainage channels and has several cross culverts along with some severe terrain on the west end of the route.

	Alternative Route					
Issues	2	3	4	5	6	7
Hydraulic – Score	2	4	10	0	8	6

### **Survey (Design & Legal Descriptions)**

Survey factors along each route are associated with the length of each route, the amount of vertical relief, the amount of features (trees, wetlands, water, structures, fences, etc.), and in reference to legal descriptions the number of parcels. Legal descriptions would be required for each parcel impacted by the proposed Right-of-Way along the route.

Findings: Route 4 will be the easiest simply because it impacts two parcels directly and has already been surveyed. Route 3 will place second as it impacts three parcels and will be very open and easy to survey. Route 7 comes in third with direct impact to one property owner and terrain

that is fairly open with the exception being CR105 and the drainage crossing. Route 6 will impact three property owners and has some difficult terrain to survey throughout the route east of Inca Road and along CR105. Route 2 will be the second to hardest for two reasons, a lot of vertical relief along the route and seven property owners along the route. Route 5 is very similar to Route 2 with even more vertical relief, two drainage crossings and five property owners, which result in this route placing last.

	Alternative Route					
Issues	2	3	4	5	6	7
Survey – Score	2	8	10	0	4	6

**Geotechnical Investigation**

Issues associated with the difficulty of a Geotechnical Investigation are as follows; the more grading required along a route, the more dirt that has to be moved. This material has to be investigated to insure it meets the requirements for use in an embankment and in a cut section of the roadway. Simple alignments that can match closely to the existing grades are preferred.

Findings: Route 3 matches the existing grade and should require minimal cuts and fills, thus placing it first. Route 4 is the shortest route with some cuts and fills and realignment of one curve on CR105. Coming in third will be Route 7 with it matching existing grade as much as possible with the exception being the channel crossing and the re-alignment of two curves on CR105. Route 2 places fourth due to large cut and fill areas and the length of the route. Route 6 while similar to Route 7 will require addition work due to large retaining walls needed. Route 5 places last due to length, large cut and fill areas and two drainage crossings.

	Alternative Route					
Issues	2	3	4	5	6	7
Geotechnical - Score	4	10	8	0	2	6

**Pavement Design**

Each route will encounter different soil classifications throughout the alignment. Different soil types require different pavement sections to be utilized. Sandy soils are generally preferred while highly expansive clayey soils are not allowed under the pavement and result in the need for mitigation. The volume of traffic and classification of the roadway also affect the required pavement section.

Findings: Route 4 is the shortest and will be constructed on a controlled embankment thus allowing for the proper material to be placed under the pavement section. Improvements to CR105

will match the existing pavement section. Therefore Route 4 will be the easiest to design the pavement section. Route 3 will place second as it matches the existing grade, with very little cut and fill and ties into an existing road. Routes 7 and 6 come in third and fourth respectfully with a balance of requirement on CR105 and Route 7 being approximately 500 feet shorter in length. Route 2 will have several different areas of cut and fill along with some major embankment being required on each side of the channel crossing. Route 5 places last, it is very similar to Route 2 with the addition of the second channel crossing and additional length.

Alternative Route						
Issues	2	3	4	5	6	7
Pavement Design - Score	2	8	10	0	4	6

### Design Difficulty

Issues	Issue Weight	Alternative Route					
		2	3	4	5	6	7
Roadway Alignment	10	0	10	8	2	6	4
		0	100	80	20	60	40
Grade	10	2	10	8	0	4	6
		20	100	80	0	40	60
Site Distance	8	0	10	6	2	4	8
		0	80	48	16	32	64
Hydraulic Analysis	6	2	4	10	0	8	6
		12	24	60	0	48	36
Survey (Design & Legal)	2	2	8	10	0	4	6
		4	16	20	0	8	12
Geotechnical Investigation	2	4	10	8	0	2	6
		8	20	16	0	4	12
Pavement Design	2	2	8	10	0	4	6
		4	16	20	0	8	12
<b>Weighted Total</b>		48	356	324	36	200	236
<b>Ranking</b>		5	1	2	6	4	3
<b>Engineering Matrix Scoring</b>		2	10	8	0	4	6

**Environmental Impacts**

An alignment closer to a stream or river typically results in a larger environmental impact. Two issues with stream crossings are; dealing with the Corp of Engineers in addressing wetlands and drainage basins, and with the Division of Fish and Wildlife associated with wildlife and their habitat. The area of disturbance associated with these impacts is generally small however the amount of mitigation required can sometimes reach a 10:1 ratio. The ability to mitigate adjacent to the project also is a factor that will reduce project costs and speed up the construction timetable.

Findings: Route 4 has the least impact, the mitigation zone is approximately 600 linear feet and an area just upstream of the proposed crossing is available for the mitigation. Route 7 places second in respect to least damage to the area, it’s mitigation length is approximately 1,000 linear feet and while mitigation could take place just down stream of the proposed crossing, most likely it would have to take place in the area of Route 4’s crossing. Route 6 will place third as it is very similar to Route 7 with the mitigation linear footage being equal at 1,000 feet. The difference with Route 6 is that the alignment of the channel is slightly skewed more than Route 7 and will require more channel work relating to more mitigation being needed. Route 3 falls in the middle with a disturbance area of approximately 1,200 linear feet. The length plus the angle of the channel, lack of a mitigation area (most likely the same as Route 6 & 7) holds this route back. Route 2 is the second worst route in reference to environmental impacts. It has a linear footage of approximately 1,200 feet at the crossing, a slight potential for mitigation in the area however it is expected that any mitigation for this route will also take place in the area of Route 4’s crossing also. The alignment on the west end of the project parallels Bear Creek with the cut and fill slopes encroaching into the flood plane. Additional mitigation will be required for this area. Route 5 comes in last place due mainly to the two crossing with a total linear footage of approximately 2,300 feet with mitigation possible to the south of the western crossing and also at Route 4’s crossing.

	Alternative Route					
Issues	2	3	4	5	6	7
Environmental - Score	2	4	10	0	6	8

**Ease of Construction and Timetable**

Ease of construction and the timetable depend on several factors. Some of these factors are: length, number of structures, length of structures, height of structures, match to existing terrain, the amount of dirt work required for the construction, the amount of work required in traffic controlled areas and the amount of mitigation required. All of the bridges and the construction along Route 2 where the alignment parallels the drainage way will need to be constructed between November 30<sup>th</sup> and March 31<sup>st</sup> due to environmental impacts and working in the Prebbles Jumping Mouse habitat.

Findings: Construction of Route 3 will be the easiest and require the least amount of time. It matches into the terrain and construction of the bridge, while it is the longest structure, will be completed in the proposed timeframe. Route 4 places second, it is one of the shortest routes and the dirt work required is in a confined area. Construction of the west half of this route will only require placement of an all weather gravel surface on the existing grade. Improvements to CR 105 will take place off of the existing alignment and will require some traffic control. Route 2 will come in third place. While it is one of the longer alignments and requires quite a bit of dirt work, this work will take place in the open and will be able to proceed quickly. The work adjacent to Bear Creek and the construction of the bridge should be accomplished in the proposed timeframe without problem. Route 7 ranks a fourth place due mainly to the amount of work required along CR 105, most of this work will require traffic control. The drainage channel work with this route will also be difficult. The improvements to existing Echo Village Road will also be constructed with traffic control being required. Route 6 follows Route 7 due to the fact that it is equal to Route 7 with the addition of retaining walls. Route 5 will require the most time due to the two structures needing to be built at the same time. The amount of dirt work required for this route is also the highest in volume.

	<b>Alternative Route</b>					
<b>Issues</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
Construction - Score	6	10	8	0	2	4

