Smiley Road Reconstruction

Driveway and Entrance Evaluations

Prepared for

City of Bridgeton, Missouri
11955 Natural Bridge Rd.
Bridgeton, MO 63044

by

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Introduction

Smiley Road Reconstruction is complete. However, questions remain as to whether the plans and construction are in conformance with the applicable design standards of St. Louis County, as adopted by the City of Bridgeton. At the City Council's request, we have reviewed the County's design standards with respect to private residential entrances and driveways, and have compared them with the Plans for Smiley Road Reconstruction to determine if the private residential entrances and driveways were designed in accordance with the applicable standards. We also conducted a field review of the as-constructed conditions to determine whether the entrances and drives are consistent with and are constructed in accordance with plans as approved.

In addition, we have reviewed the design standards of similar municipalities in St. Louis County, and found them all to default to St. Louis County for their Street Design Standards. Municipalities that we checked include: Maryland Heights, Hazelwood, Creve Coeur, Ellisville. In addition, though not listed, we have worked in the many more local municipalities and jurisdictions that have adopted and use St. Louis County Design Standards as their own.

Design standards, for the most part, are guidelines. They establish an acceptable range within which the relevant feature should be designed. In general, it is most desirable to try to design toward the middle of the applicable range, and it is left to the designer to use appropriate judgment as they design within those limits. Even when designing within the accepted standards, however, there are many factors and considerations that ultimately affect a design. Our review is limited to comparison of the entrances and drives to the applicable standards, as we are not aware of the factors and considerations that would have affected design within the standard range.

Background

For the most part, homes on the west side of Smiley Rd. are at elevations significantly above the roadway and the homes on the east side are at elevations below the roadway (several are significantly lower). The difference in elevation from side to side (and the fact that some of the differences are extreme) posed a significant design challenge.

The design engineer had the task of balancing roadway design standards along with the entrance design standards, and reaching a balance point. Due to the extreme elevation change between the homes on the east and west sides of the street, an adjustment favoring one side will, in most cases, negatively affect the steepness of the drives on the opposite side of the street. The engineer had to consider the driveway grades along with street design standards, construction budget, etc. as they arrived at the final design.

Plan Review

Entrances: We concur that the entrances within public right-of-way (from the street pavement to the back of sidewalk) have been designed and constructed in accordance with St. Louis County Highway Department Standards for residential entrances. It is standard practice to maintain a continuous, parallel sidewalk, within the right-of-way; and for the right-of-way to drain toward the street with storm sewers to convey the runoff. The County's entrance detail accommodates all of these things and is (and has been for decades) used as a standard throughout the metropolitan area for residential drives.

Plan Review (continued)

Driveways: We also concur that the driveways were designed in accordance with the St. Louis County Standards, with a qualification. St. Louis County's standard detail indicates a "desired maximum grade of 15%" (15-feet of rise or fall for every 100' of driveway length). The reason for the word "desired" is to allow for flexibility that is often times needed in isolated circumstances to make a project work. In the Smiley Road Plans, the entrance / driveway detail indicates a "maximum" grade of 20%. Given the extreme differences in elevation and the several relatively steep drives that existed prior to construction, it is our opinion that the establishment of 20% as a limit is reasonable.

Generally, it is easier to accommodate a steeper grade on a driveway that goes up from the street than for a drive that goes down. The Smiley Road Plans are consistent with that. The steepest design grades on the driveways are on the west side, on "up" drives, while the "down" drives on the east are limited to a maximum design grade of -15% as recommended in the County's detail. There is, however, a slight ambiguity in the plans. The driveway detail includes a vertical curve at each end of the new pavement, one that begins at the sidewalk and a second one at the end where it meets the existing driveway pavement, see Figure A. These curves are intended to temper the severity of a grade break, and they are most important on "down" drives, as they provide additional ground clearance. The driveway sections, which were prepared individually for each driveway and provide the details used to establish the specific drive elevations, did not include the vertical curves. The contractor was required to make the interpretation and warp them in the field. Vertical curves are not needed in many cases, so it is not uncommon for plans to be prepared this way. However, not having them shown in the individual driveway sections provides an easy opportunity for the drives to be constructed without them.

As noted above, the vertical curve is most important on "down" driveways and, while it is good practice to include them at points where the down grade will be steeper than 4%, they are much more important when the down grade exceeds -10%, see Figure B. They are not as important on the "up" driveways, due to the up angle of the car as it crosses the walk and continues up, see Figure C for illustration.

Field Review

Entrances: As indicated above, all of the private residential entrances have been constructed in substantial conformance with the Plans.

Driveways: We have field measured what we believe to be average maximum slopes for each drive, and have noted whether the drive was built with a vertical curve as indicated in the detail. A summary of the plan conditions vs. field observations is attached, Table 1. As indicated prior, the vertical curve is not needed in many cases. We have noted on Table 1 N/A for those drives that would not significantly benefit from a vertical curve, and though it is good practice to construct them, based on our observations, it appears that all of the driveways will function adequately for an average passenger vehicle.

Field Review (continued)

We found a total of four "down" drives steeper than -10% that were constructed with no significant vertical curve, and though they are adequate for an average passenger vehicle, a low-slung vehicle, such as a Corvette, will likely drag as it crosses over the sidewalk. The four driveways that would benefit from a vertical curve are as follows:

Station 37+44 Rt., 3108 Smiley Rd.

Station 39+48 Rt., 3126 Smiley Rd.

Station 49+68 Rt., 3202 Smiley Rd.

Station 50+73 Rt., 3202 Smiley Rd.

In our observations, we also noted "drag marks" on the pavement in three locations:

Station 32+05 Rt., 3068 Smiley Rd.

Station 35+02 Lt., 3081 Smiley Rd.

Station 49+68 Rt., 3202 Smiley Rd.

We were told by a gentleman that was working at #3068 that the marks were made by a trailer while delivering or retrieving construction equipment. The homeowners at #3081 told us that the marks were made by a trailer that we understood to be a large camper, and we observed a picture of a trailer dragging at #3202, Station 49+68 Rt. It is important to note that there were no marks on the drives at #3108, #3126, or #3202 (Sta. 50+73 Rt.).

Observation Summary and Conclusions

It is our opinion that all drives currently function adequately for an average passenger vehicle. The four drives noted above, however, would benefit from a vertical curve beginning at the back of sidewalk. Figures B & C depict a 2008 Chevrolet Malibu passing through the maximum "up" and "down" conditions as measured and observed in the field.

Note Regarding Trailers and Specialty Vehicles

Private residential entrances are not designed to accommodate specialty vehicles such as trailers and recreational vehicles. Specifically, long, low trailers and vehicles or trailers with long overhangs are difficult to accommodate in a residential driveway. For the occasional need, it is likely that these drives could accommodate a trailer that may otherwise drag by using wooden cribbing or other material placed so that either the trailer or tow vehicle wheels run over it raising them to the point that dragging will be avoided. If more frequent or more convenient use is required, it is likely that the drives in question could be modified to accommodate the desired vehicle. However, this would be beyond the scope of a normal residential street reconstruction project, and in these specific cases, would require a significant additional length of driveway replacement (well beyond the easement limits).

As an aside, we have been involved in past, similar projects, where specific accommodations were made for a particular property owner's needs. In cases, that accommodations were made, they were a result of the property owner making the request during the right-of-way negotiation stage. Plans were then appropriately modified prior to construction.

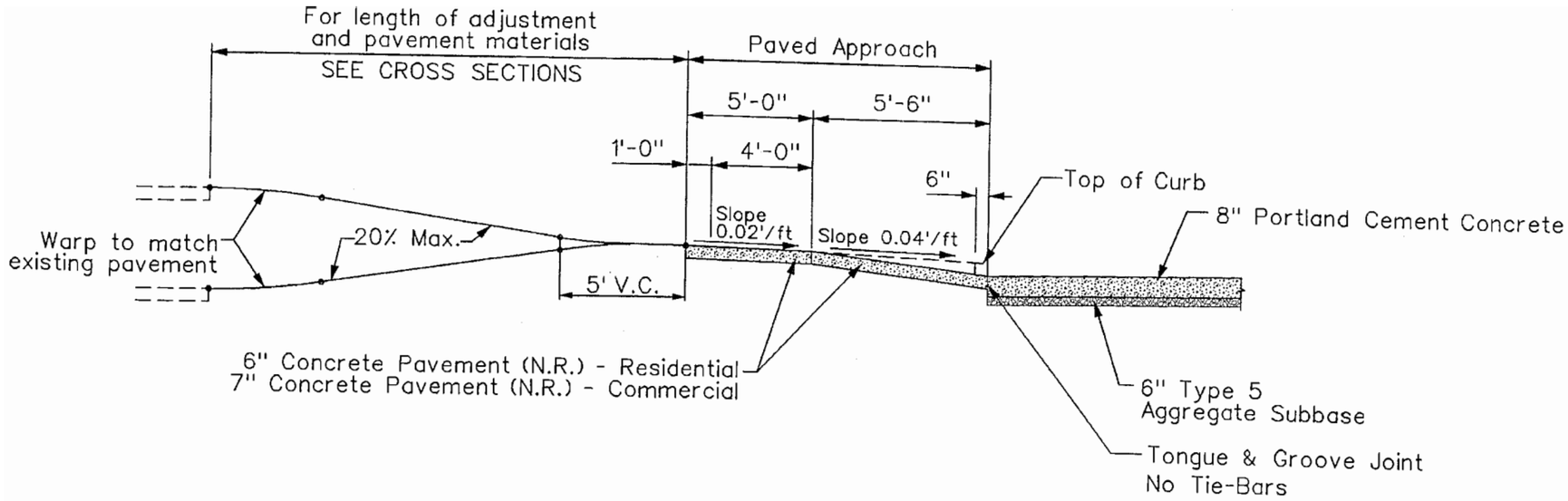
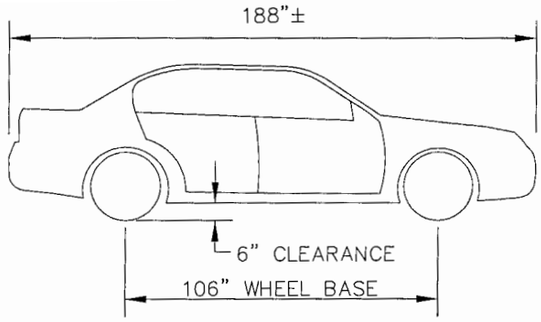


FIGURE A: TYPICAL DRIVEWAY SECTION

NO SCALE

DETAIL PER SMILEY ROAD IMPROVEMENT PLANS
SHEET 3B OF 74 – TYPICAL SECTION
DATED 11/03/03



STANDARD 4-DOOR SEDAN

CHEVY MALIBU

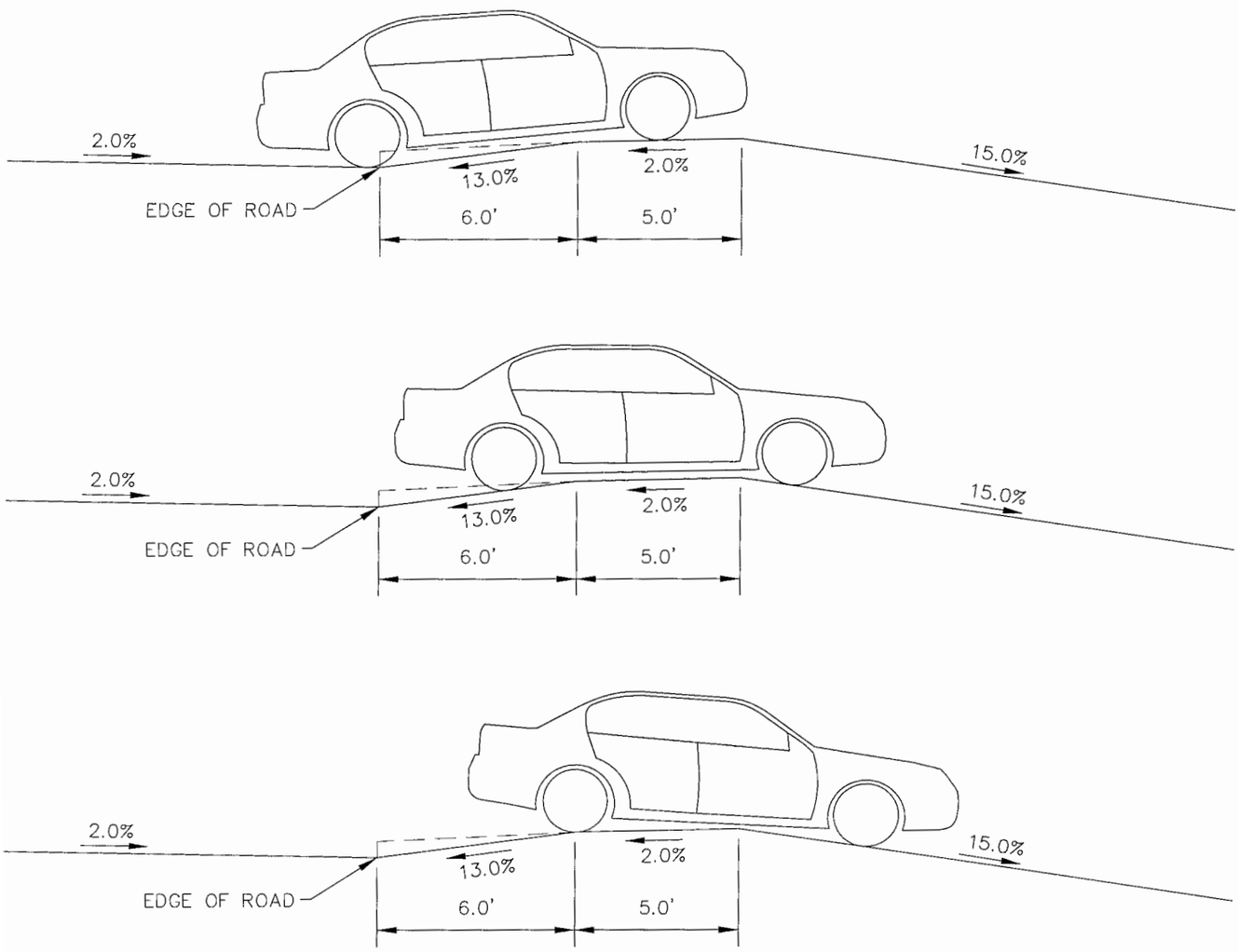


FIGURE B: DRIVEWAY SECTION W/OUT VERT. CURVE

SCALE: 1" = 5'

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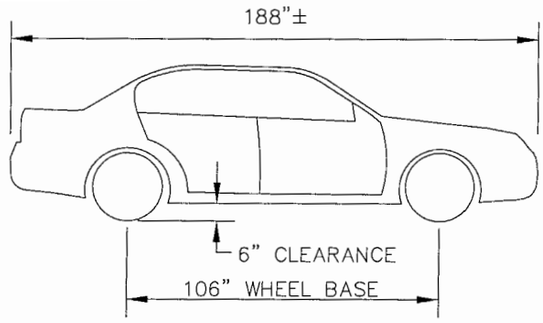

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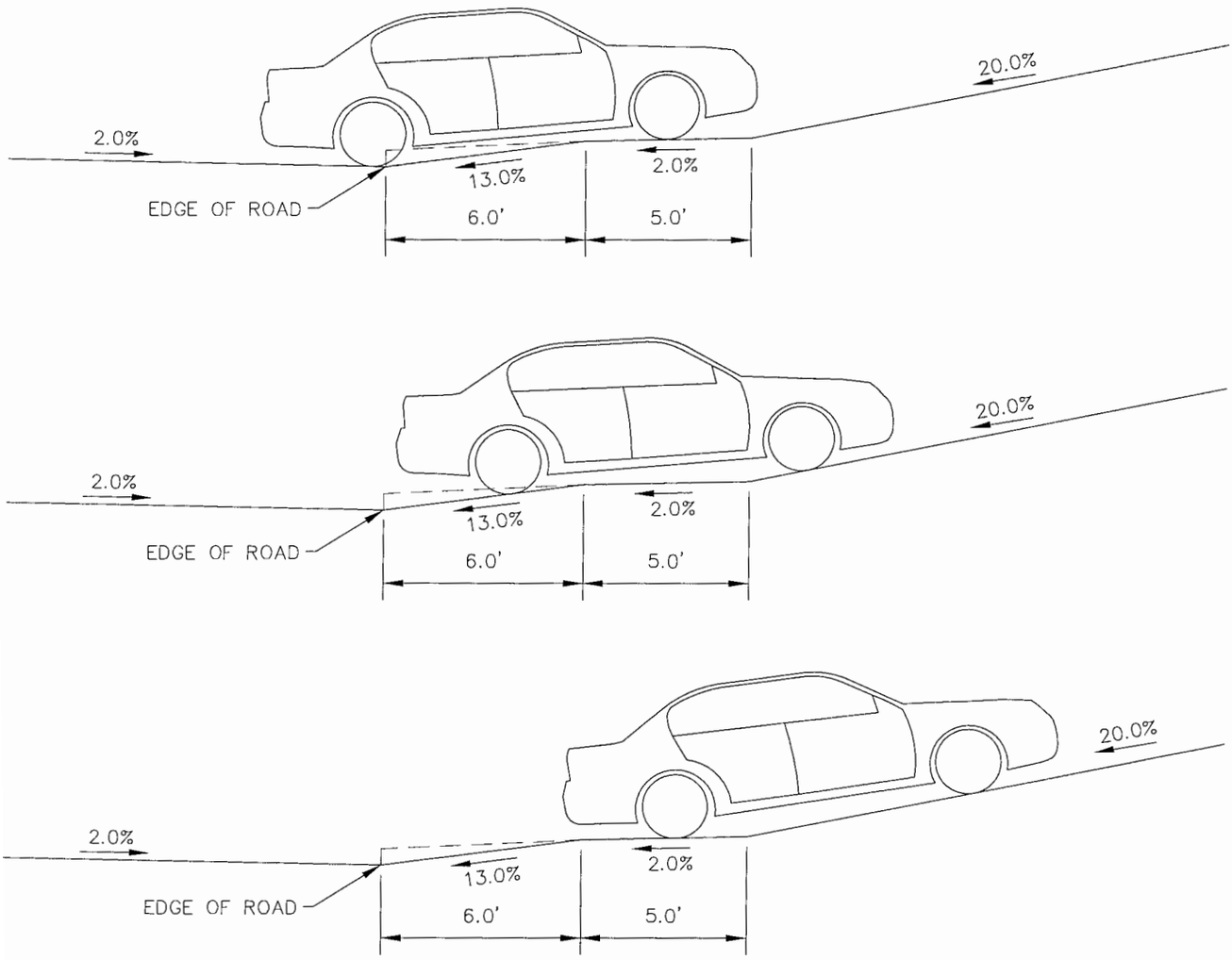

FIGURE C: DRIVEWAY SECTION W/OUT VERT. CURVE

SCALE: 1" = 5'

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Smiley Road Reconstruction
Entrances Driveways
Plan vs. Field Observations

Table 1

Address	Owner	Station	Grade (%)		Variance	Vertical Curve	Comments
			Plan	Measured			
3044	Valli	28+45 Rt	1.0	2.8	1.8	N/A	
3050	Vogel	28+68 Rt	1.0	1.0	0.0	N/A	
3051	Harrington	29+57 Lt	-9.0	-7.5	-1.5	Y	
3063	Bovier	30+23 Lt	-10.0	-6.2	-3.8	Y	
3062	Noonan	30+93 Rt	-10.0	-9.8	-0.2	Y	
3068	Brawner	32+05 Rt	-12.0	-18.3	6.3	Y	Trailer gouge in asph drive
3069	McConnell	32+38 Lt	2.0	1.7	-0.3	N/A	
3074	Schmidle	33+63 Rt	16.0	14.7	-1.3	N	
3075	Cuneo	33+96 Lt	18.0	20.5	2.5	Y	Short Warp (2' +/-)
3080	Maine	34+22 Rt	10.0	11.1	1.1	N/A	
3080	Maine	34+99 Rt	-8.0	-4.5	-3.5	Y	
3081	Hull	35+02 Lt	15.0	14.3	-0.7	N	Drag Marks 15' +/- up drive
3102	Fox	35+91 Rt	-10.0	-14.0	4.0	Y	
3108	Bishop	36+20+/- RT		-16.4		Y	Drive Not on Plans
3093	Camenzind	36+27 Lt	14.0	12.9	-1.1	N/A	
3105	Hedrick	36+62 Lt	16.0	18.0	2.0	N	
3108	Bishop	37+44 Rt	-14.0	-11.8	-2.2	N	
3105	Hedrick	37+65 Lt	17.0	15.1	-1.9	N	
3109	Buddhist Ctr	38+17 Lt	15.0	17.5	2.5	N	
3120	Gross	38+99 Rt	-14.0	-13.2	-0.8	Y	
3126	Dizon	39+48 Rt	-12.0	-9.8	-2.2	N	
3132	Kreitler	40+42 Rt	-14.0	-6.2	-7.8	Y	
3109	Buddhist Ctr	42+83 Lt	-4.0	0.2	-4.2	N/A	
3145	Fitzgerald	44+05 Lt	1.0	3.0	2.0	N/A	
3150	Zanzie	44+89 Rt	-3.0	-2.0	1.0	N/A	
3156	Roberson	45+36 Rt	-3.0	-1.2	-1.8	N/A	
3157	Kelley	46+09 Lt	8.0	8.2	-0.2	N/A	
3162	Basta	46+43 Rt	-2.0	0.4	-2.4	N/A	
3168	Byrne	47+34 Rt	0.0	0.0	0.0	N/A	
3167	Perkins	47+40 Lt	10.0	9.8	-0.2	Y	
3174	Wallis	48+19 Rt	-7.0	-8.1	1.1	Y	
3175	Weseloh	48+38 Lt	8.0	7.7	-0.3	Y	
3202	Jackson	49+68 Rt	-15.0	-14.4	-0.6	N	Drag Marks on Walk
3202	Jackson	50+73 Rt	-15.0	-11.0	-4.0	N	
3208	Serra	51+32 Rt	-15.0	-19.2	4.2	Y	
3207	Grace Chrch	51+66 Lt	13.0	14.3	1.3	N/A	
3220	Serra	52+83 Rt	-15.0	-16.5	1.5	Y	
3213	Vogel	52+97 Lt	16.0	15.3	0.7	Y	
3221	Henry	53+81 Lt	10.0	14.9	4.9	N	
3229	Steller	54+86 Lt	15.0	20.5	5.5	N	
3239	Wurm	56+08 Lt	8.0	13.9	5.9	Y	
3245	Norman	57+05 Lt	1.0	7.0	6.0	N/A	
11902 OSR	Krohn	59+07 Lt	1.0	2.0	1.0	N/A	
11820 OSR	Grisham	59+79 Rt	3.0	8.5	5.5	Y	

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Private Residential Entrance / Driveway Standards Recommendations

Because there will always be a unique situation that requires special consideration, we recommend that the City maintain the current standards and that the flexibility remain with the design engineer to design appropriate solutions. For the limited situations that require a solution outside of the desirable standard range, our recommendation is to add conditions such that the design engineer will provide the Public Works Director with appropriate justification for each specific location. We would not expect for the approval to be withheld unreasonably, but the additional scrutiny should lead to a more thorough evaluation of options.

Recommended Supplemental Design Standards / Requirements

1. Vertical curves (V.C.) shall be required for all vertical grade breaks with an algebraic difference greater than 6% for crest breaks and 12% for sag breaks, unless approved otherwise by the Director of Public Works.*

2. When driveway sections are provided as part of the improvement plans, the vertical curves shall be included in the section.

3. Maximum desirable driveway grades shall be 15% (up or down). Grades in excess of 15% may be approved by the Director of Public Works.*

* - Any variance to the requirements of Notes 1 & 2 shall be approved separately for each specific location upon the Director's review and concurrence of the necessity and appropriateness of the request.

Summary

Though it is tempting to suggest hard limits that would prevent any designs outside of a specified range, it is very likely that there will be a situation in the near future that will challenge the limits, either requiring a variance or a modification to the roadway design. It is important to avoid a situation in which a single driveway dictates a less than desirable street design strictly to accommodate a limiting standard for a private driveway. Our recommendation is make sure designs outside of the desired range are justified and clearly documented. It is then important for the information to be provided to the property owner so that they have the ability to comment.

With appropriate documentation and communication, we feel that the standards currently in place will serve the City well on future projects.