

TRANSPORTATION SYMPOSIUM

2019

Design Exceptions & Variations: Florida Greenbook

Mary Anne Koos and Brad Bradley

Ybor City, Florida



FDOT District 7

Fort Lauderdale, FL



FDOT District 4



**Manual of Uniform Minimum
Standards for Design,
Construction and Maintenance for
Streets and Highways**

(Commonly known as the Florida Greenbook)

<https://www.fdot.gov/roadway>

DRAFT

FDOT Office
Office of Design
Topic # 625-000-015

Date of Publication
2018 Edition

2018 Florida Greenbook



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*Expected Adoption
Fall 2019*

DRAFT

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for Design, Construction and Maintenance
for Streets and Highways

2018

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Committees
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Geometric Design
Roadside Design
Drainage Design and Construction
Signage
Interchange and Highway Crossings
Pedestrian Facilities
Bicycle Facilities
Maintenance and Resurfacing
Work Zone Safety
Construction
Public Transit
Design Exceptions and Variations
Traffic Calming
Residential Street Design
Bridges and Other Structures
Signing and Marking
Traditional Neighborhood Development
Drainage

*Read Chapter 14
for the Details!*

THE ROAD AHEAD



A - General

B - Recommendations

C - Coordination

D - Justification

E - Doc for Exceptions

F - Doc for Variations

G - Final Processing



Fernando Alcantara

A - GENERAL

Design
Construction
Maintenance

- Uniform Minimum Standards
- Greenbook Meets/Exceeds AASHTO Minimums
- Governs Design
- Early Documentation & Approval
- Design Exception \neq Criteria Controlling Elements

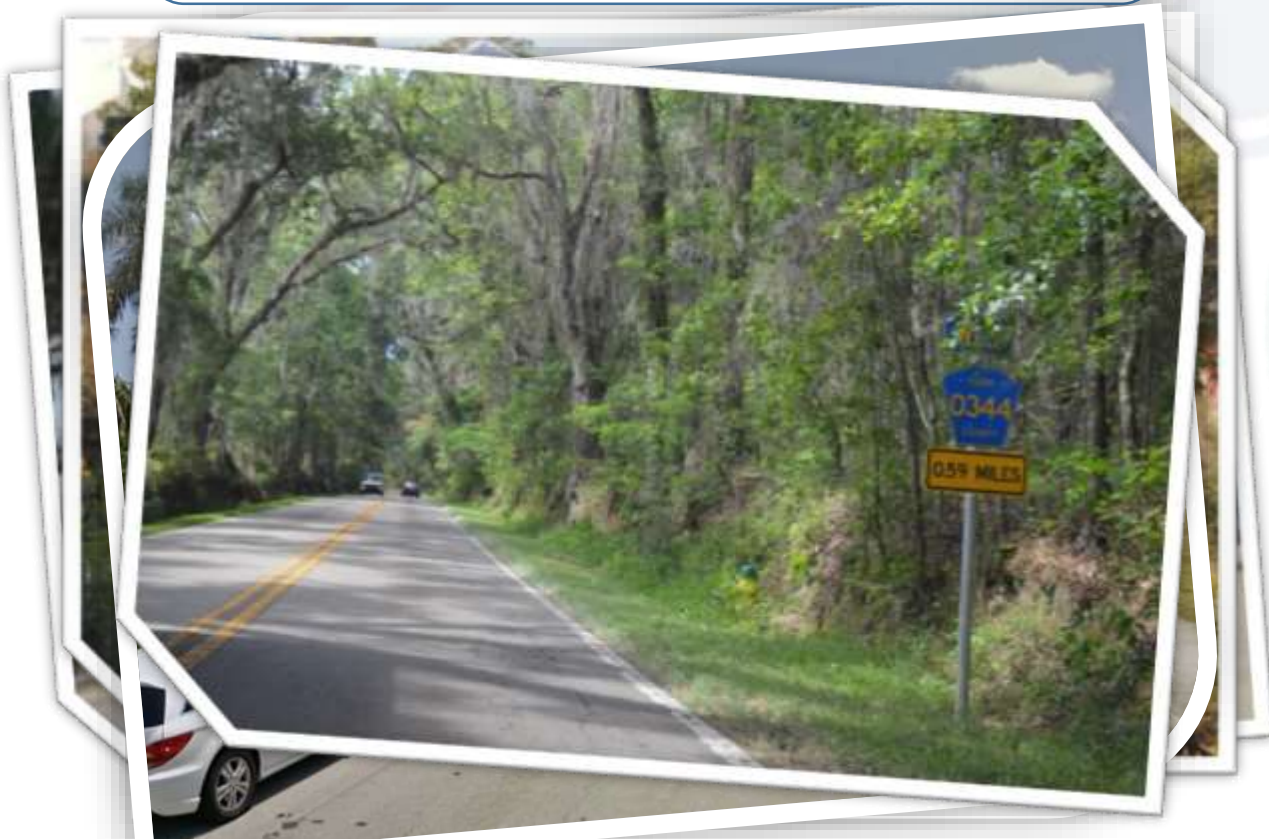
DE = Design Exception
Miami, FL



$DS \geq 50 \text{ mph}$ A - GENERAL

- 10 High Speed Controlling Elements

- Design Speed
- Lane Width
- Shoulder Width
- Horizontal Curve Radius
- Superelevation Rate



~~Shoreline Community College, Ft. Belcher, FL~~

$DS \geq 50 \text{ mph}$

A - GENERAL

Each block = 1 ton
truck + blocks =
200,000 lbs or
100 tons (200 kips)

- 10 High Speed Controlling Elements

- Stopping Sight Distance

- Maximum Grade

- Cross Slope

- Vertical Clearance

- Design Loading
Structural Capacity



~~Subgrade, FILL~~

DS < 50 mph A - GENERAL

- 2 Low Speed Controlling Elements

- Design Speed

- Design Loading Structural Capacity

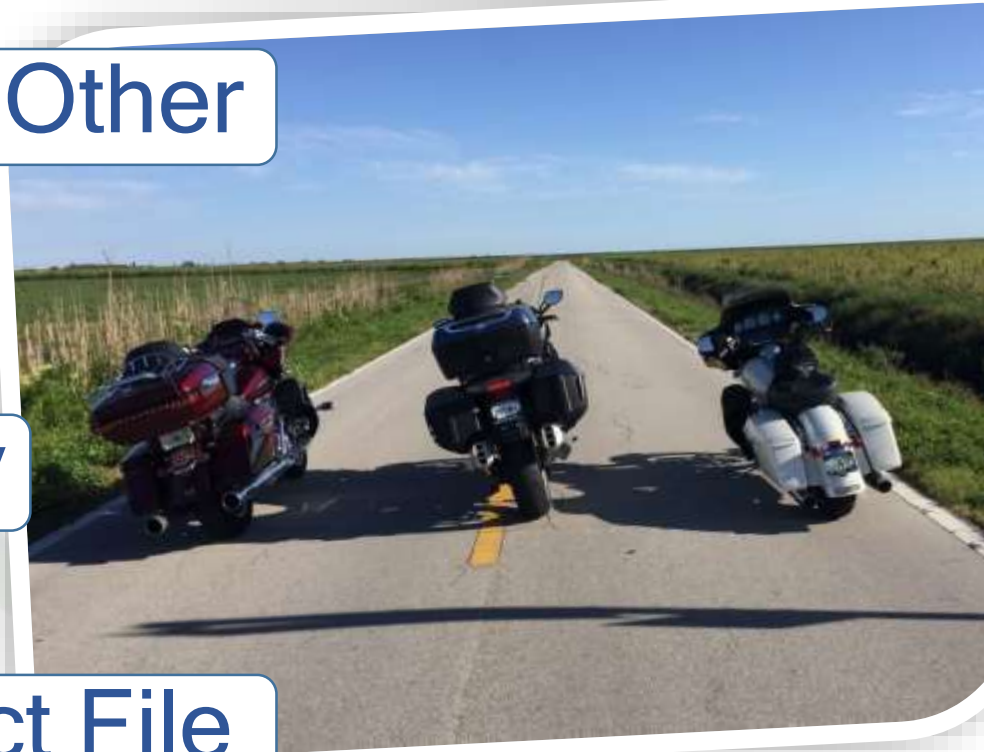


Alternatives to County FLFL

A - GENERAL

DV = Design Variation

- Design Variation \neq Criteria - All Other
- Responsible P.E.
 - Doc detail & justification
 - Submit to municipality/county
- The Process
 - Doc Action & Approval in Project File
 - Subdivision Roads/Residential Streets



Okeechobee, FL

B - RECOMMENDATIONS

- Recommended by Responsible P.E.
- Approved by Maintaining Authority's P.E./Designee
- Involves Facility on SHS or NHS
 - Processed thru Dept.'s District Design Engineer
 - DDEs follow FDOT Design Manual, Ch. 122
 - Concurrence from FHWA

C - COORDINATION

- Identify Exception/Variation Early
 - Planning/initial design
 - Research alternatives
 - Analysis & documentation
- Conceptual Concurrence
 - Authority's P.E./designee
 - Department (if applicable)



Live Oak, FL

C - COORDINATION

- Department Involved
 - Proposed is part of a Department project
 - SHS project with work on adjacent local roads
 - Exclusively on local road
 - DDE/FHWA “concurrency”

Pahoke, FL



D - JUSTIFICATION

- Provide Sufficient Detail and Explanation
- The 10 Controlling Elements are Safety Related
- Strongest Case Possible to Lower Requirements
- All Deviations Must be Uniquely:
 - Identified
 - Located
 - Justified

Orlando, FL



D - JUSTIFICATION

- A strong case can be made if:



Gainesville, FL

- Criteria are not applicable to the site
- Just as safe when not following criteria
- Environmental/ community needs limit ability to meet criteria

D - JUSTIFICATION

- Most often a case is made by showing required criteria are impractical and proposed design balances all impacts to:

- Safety & operational performance

- Level of service

- Right-of-way

- Community

D - JUSTIFICATION

- Most often a case is made by showing required criteria are impractical and proposed design balances all impacts to:

- Environment

- Costs

- Usability by all modes

- Long term & cumulative effects on adjacent sections

D - JUSTIFICATION

- A case should not be made based solely on:

- Saving money

- Saving time

- Proposed design is similar to other designs



Redlands, FL

E - DOC for DE

1. Submittal/Approval Letter (Exhibit 14-A):

Exhibit 14-A Sample Request Letter for Design Exception or Variation

Exhibit 14-A Sample Request Letter for Design Exception or Variation

TO: _____ DATE: _____

SUBJECT: ☐ DESIGN EXCEPTION or ☐ DESIGN VARIATION

Local road number or street name: _____
Project description (limits): _____
Type construction (new, rehabilitation, adding lanes, resurfacing, etc.) _____
Design Speed _____
State and/or Federal road number (if applicable): _____
FDOT Financial Project ID No. (if applicable): _____

DESIGN EXCEPTION OR VARIATION FOR THE FOLLOWING ELEMENT:

<input type="checkbox"/> Design Speed	<input type="checkbox"/> Stopping Sight Distance	<input type="checkbox"/> Other (explain): _____
<input type="checkbox"/> Lane Width	<input type="checkbox"/> Maximum Grade	_____
<input type="checkbox"/> Shoulder Width	<input type="checkbox"/> Cross Slope	_____
<input type="checkbox"/> Horizontal Curve Radius	<input type="checkbox"/> Vertical Clearance	_____
<input type="checkbox"/> Superelevation Rate	<input type="checkbox"/> Design Loading Structural Capacity	_____

Approval: _____
(Maintaining Authority's Professional Engineer or Designee)

Concurrence: _____
FDOT (if applicable)

Concurrence: _____
FHWA (if applicable)

E - DOCUMENTATION for DE

TO: _____

DATE: _____

SUBJECT:

☐ **DESIGN EXCEPTION** or ☐ **DESIGN VARIATION**

Local road number or street name: _____

Project description (limits): _____

Type construction (new, rehabilitation, adding lanes, resurfacing, etc.) _____

Design Speed _____

State and/or Federal road number (if applicable): _____

FDOT Financial Project ID No. (if applicable): _____

DESIGN EXCEPTION OR VARIATION FOR THE FOLLOWING ELEMENT:

() Design Speed

() Lane Width

() Shoulder Width

() Horizontal Curve Radius

() Superelevation Rate

() Stopping Sight Distance

() Maximum Grade

() Cross Slope

() Vertical Clearance

() Design Loading Structural Capacity

() Other (explain):

E - DOCUMENTATION for DE

1. Submittal/Approval Letter (Exhibit 14-A):

Topic # 625-000-015
Manual of Uniform Minimum Standards
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2018
Revised March 27, 2018

Exhibit 14-A Sample Request Letter for Design Exception or Variation

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SUBJECT: ☐ DESIGN EXCEPTION or ☐ DESIGN VARIATION

Local road number or street name: _____
Project description (limits): _____
Type construction (new, rehabilitation, adding lanes, resurfacing, etc.): _____
Design Speed _____
State and/or Federal road number (if applicable): _____
FDOT Financial Project ID No. (if applicable): _____

DESIGN EXCEPTION OR VARIATION FOR THE FOLLOWING ELEMENT:

<input type="checkbox"/> Design Speed	<input type="checkbox"/> Stopping Sight Distance	<input type="checkbox"/> Other (explain): _____
<input type="checkbox"/> Lane Width	<input type="checkbox"/> Maximum Grade	_____
<input type="checkbox"/> Shoulder Width	<input type="checkbox"/> Cross Slope	_____
<input type="checkbox"/> Horizontal Curve Radius	<input type="checkbox"/> Vertical Clearance	_____
<input type="checkbox"/> Superelevation Rate	<input type="checkbox"/> Design Loading Structural Capacity	_____

Include a brief statement concerning the project and items of concern.
Attach all supporting documentation to this exhibit in accordance with Chapter 14.

Recommended by: _____
(Responsible Professional Engineer)

Include a brief statement concerning the project and items of concern.

Attach all supporting documentation to this exhibit in accordance with Chapter 14.

E - DOCUMENTATION for DE

Recommended by: _____
(Responsible Professional Engineer)

Approval: _____
(Maintaining Authority's Professional Engineer or Designee)

Concurrence: _____
FDOT (if applicable)

Concurrence: _____
FHWA (if applicable)

Tim Tebow

2018
Revised March 27, 2018

Request Letter for Design Exception or Variation

DATE: _____

ON or ☐ DESIGN VARIATION

street name: _____
(its): _____
(e.g., rehabilitation, adding lanes, resurfacing, etc.) _____

road number (if applicable): _____
street ID No. (if applicable): _____

FOR THE FOLLOWING ELEMENT:

☐ Stopping Sight Distance ☐ Other (explain): _____
☒ Maximum Grade _____
☐ Cross Slope _____
☐ Vertical Clearance _____
☐ Design Loading Structural Capacity _____

comment concerning the project and items of concern. _____
documentation to this exhibit in accordance with Chapter 14. _____

(Professional Engineer or Designee)

Design Exceptions and Variations 14-12

E - DOCUMENTATION for DE

2. Project Description:



a) General project info, location map, existing characteristics, project limits (Sta./MP) county section number, work mix, objectives, and obstacles

Not Sure This is In FL???

E - DOCUMENTATION for DE

2. Project Description:

b) Associated/future limitations that exist as a result of public/legal commitments



Dunedin, FL

E - DOCUMENTATION for DE

3. Project Schedule and Lifespan:



a) Letting date and other important production dates

b) Temporary/
permanent condition

c) Future work planned/
programmed

Mexico Beach, FL ²⁷

E - DOCUMENTATION for DE

Nominal

4. Exception Description:

a) Specific criteria not met and why

b) Proposed design value and why

c) Plan view, plan sheet, or aerial photo with ROW lines & adjacent property parcel lines



Florida Border

E - DOCUMENTATION for DE

4. Exception Description:



d) Photo of area with deficiency

e) Typical section/
cross-section

f) Station/Milepost
location

Tallahassee, FL

E - DOCUMENTATION for DE

5. Alternative Designs Considered:

a) Meeting AASHTO/
Greenbook criteria

b) Proposed design

c) Existing (no-build)



Navarre, FL

E - DOCUMENTATION for DE

Substantive

6. Impacts of the Exception:

- a) Safety performance:
 - short, long, cumulative
 - most recent 5-year crash history



Palm Beach, FL

E - DOCUMENTATION for DE

6. Impacts of the Exception:



- b) Operational performance:
- Short, long, cumulative
 - Amount & character of traffic
 - Compatibility with adjacent sections
 - Effects on capacity & level of service

Somewhere in FL

E - DOCUMENTATION for DE

6. Impacts of the Exception:

c) Right-of-way

d) Community

e) Environment

f) Usability by all modes



Sarasota, FL

E - DOCUMENTATION for DE

7. Anticipated Costs:



For example,

- Design
- Right-of-way
- Construction
- Maintenance

Broward/Palm Beach

E - DOCUMENTATION for DE

8. Mitigation Measures:



Discuss,

- Mitigation measures/ alternatives considered
- Any selected treatments implemented

Madeira Beach, FL

E - DOCUMENTATION for DE

9. Summary and Conclusions

Lee Co., FL





Mitigation Strategies for Design Exceptions

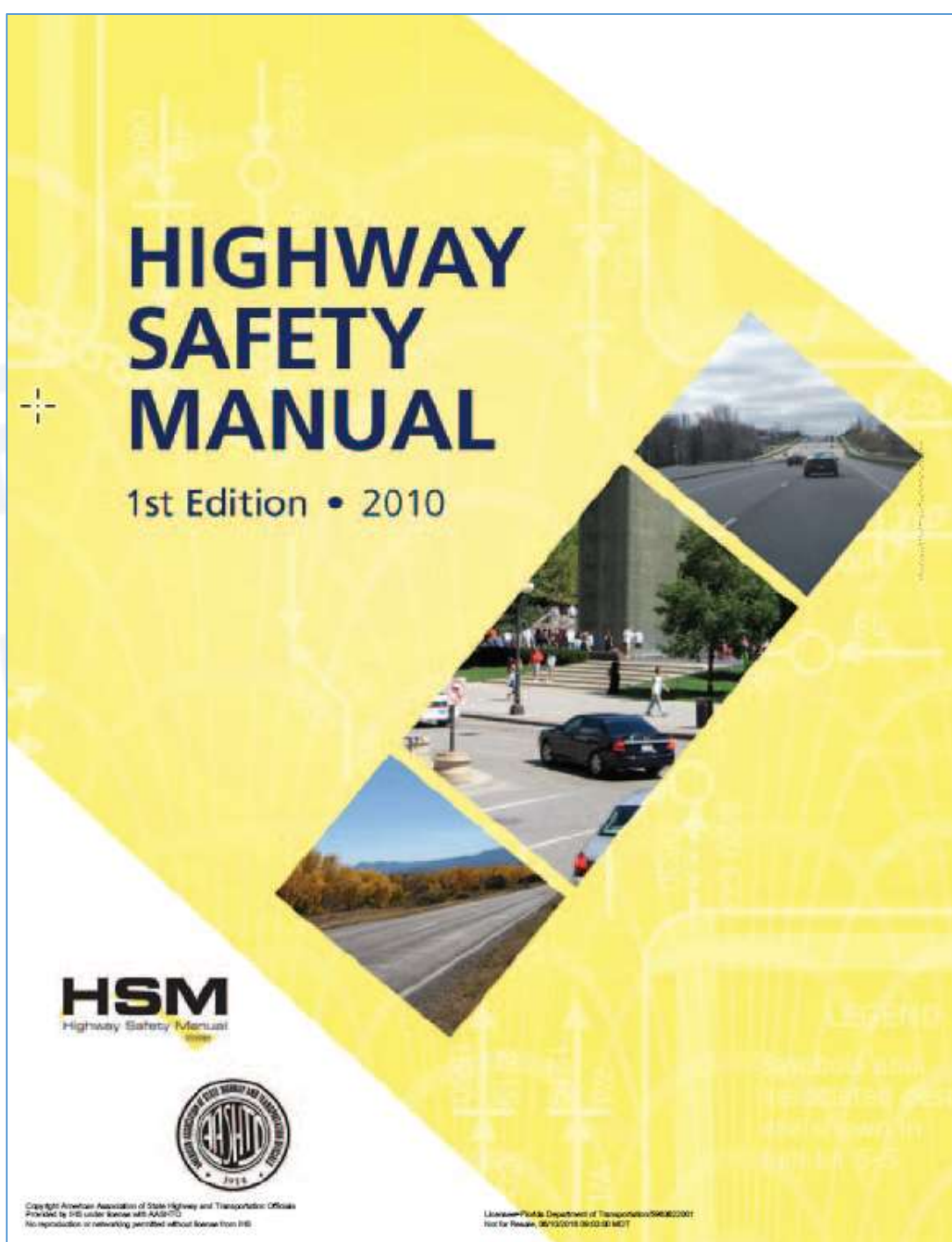
July 2007



E - DOC for DE

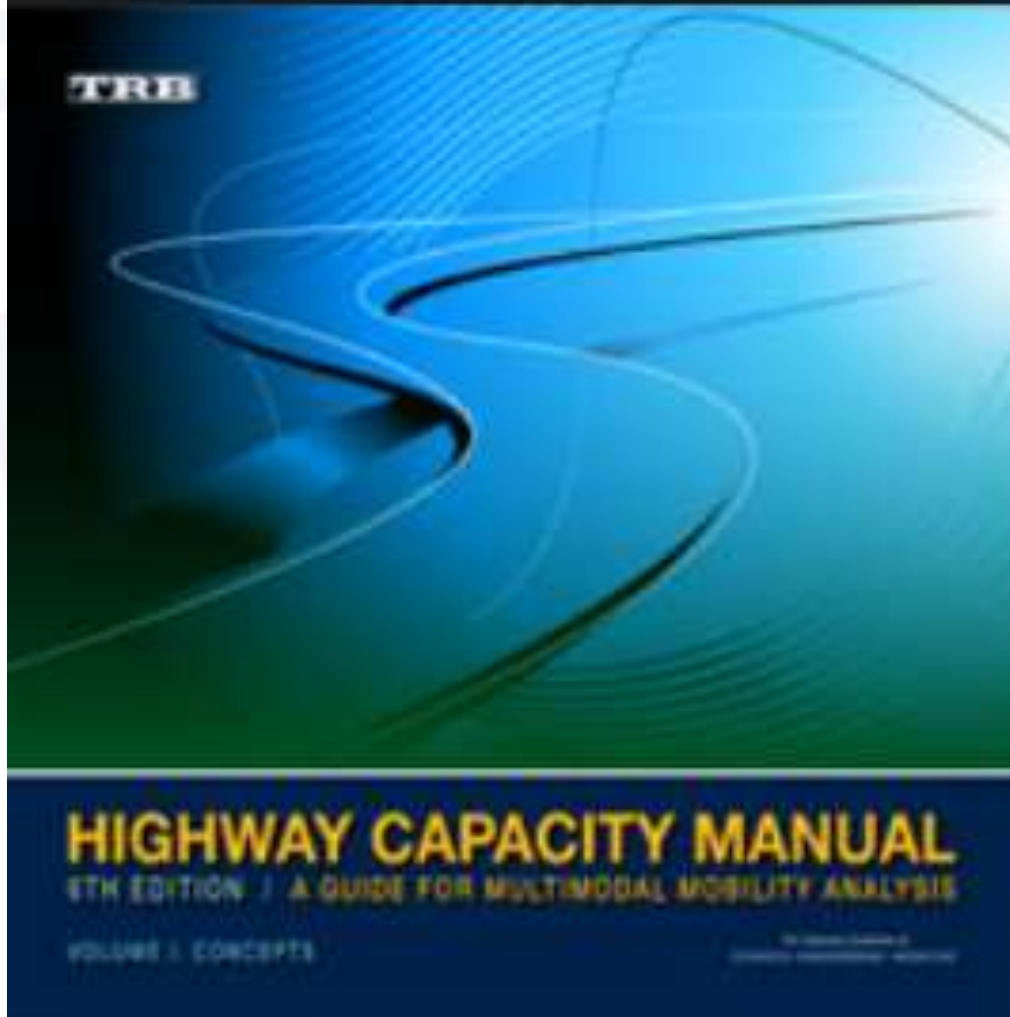
- Mitigation Strategies for Design Exceptions (July 2007)

E - DOC for DE



- Highway Safety Manual (HSM)

E - DOC for DE



- Highway Capacity Manual (HCM)

E - DOCUMENTATION for DE

- Benefit/Cost (B/C Ratio) Analysis:
 - B = Benefit of expected reduction in future crash costs
 - C = direct Cost of design, construction and maintenance

Clermont, FL



E - DOCUMENTATION for DE

- Benefit/Cost (B/C) Analysis:
 - Estimates the cost effectiveness of correcting/mitigating a substandard design element
 - Annualized for direct comparison between design alternatives

Capture the Δ

Jupiter, FL



E - DOCUMENTATION for DE

- Benefit/Cost (B/C) Analysis:
 - $B/C \geq 1.0$, means particular design may be cost effective
 - Final decision lies with management:
 - Applies sound engineering judgement
 - All factors

Pensacola, FL



E - DOCUMENTATION for DE

- Benefit/Cost (B/C) Key Factors:
 - Crash evaluation by type & cause
 - Crash cost estimate (KABCO)
 - Crash Reduction Factor (CRF) for mitigation
 - Discount rate
 - Design, Construction & Maintenance estimates
 - Improvement service life

E - DOCUMENTATION for DE

- Conclusion & Recommendation:
 - a) Cumulative effect of other deviations
 - b) Safety mitigating measures considered & provided
 - c) Summarize specific course of action

Tampa, FL



F – DOCUMENTATION for DV

- Design Variations for elements other than the 10 Controlling Elements should include:

- a) Design criteria versus proposed value

Nominal

- b) Reason design criteria are not appropriate

- c) Justification for proposed criteria

Substantive

- d) Analysis of most recent 5-year crash history

- e) Background info documenting request

G - FINAL PROCESSING

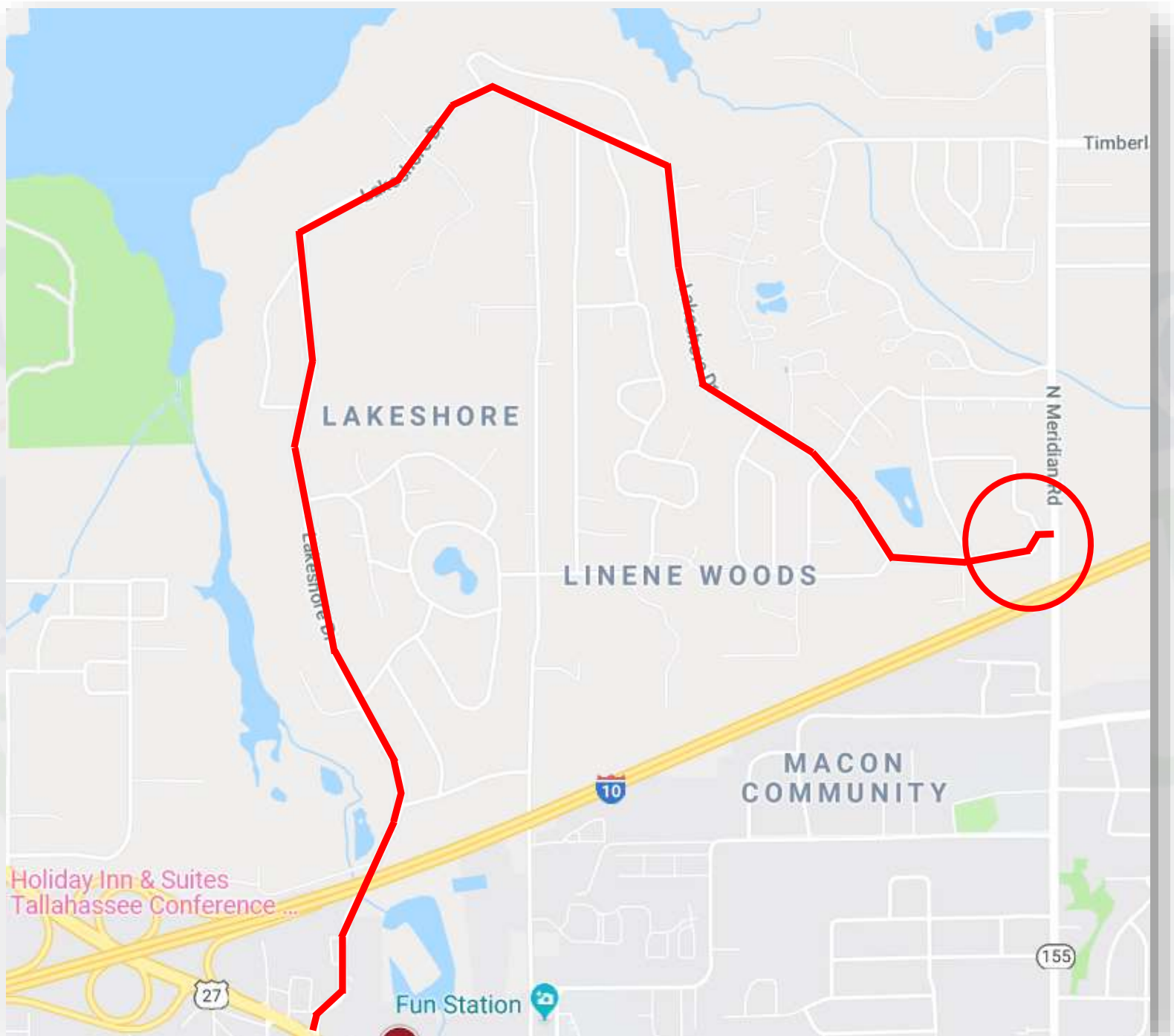
- Signed & Sealed by Responsible P.E.
- After receiving conceptual approval
- Delivered to municipality/county

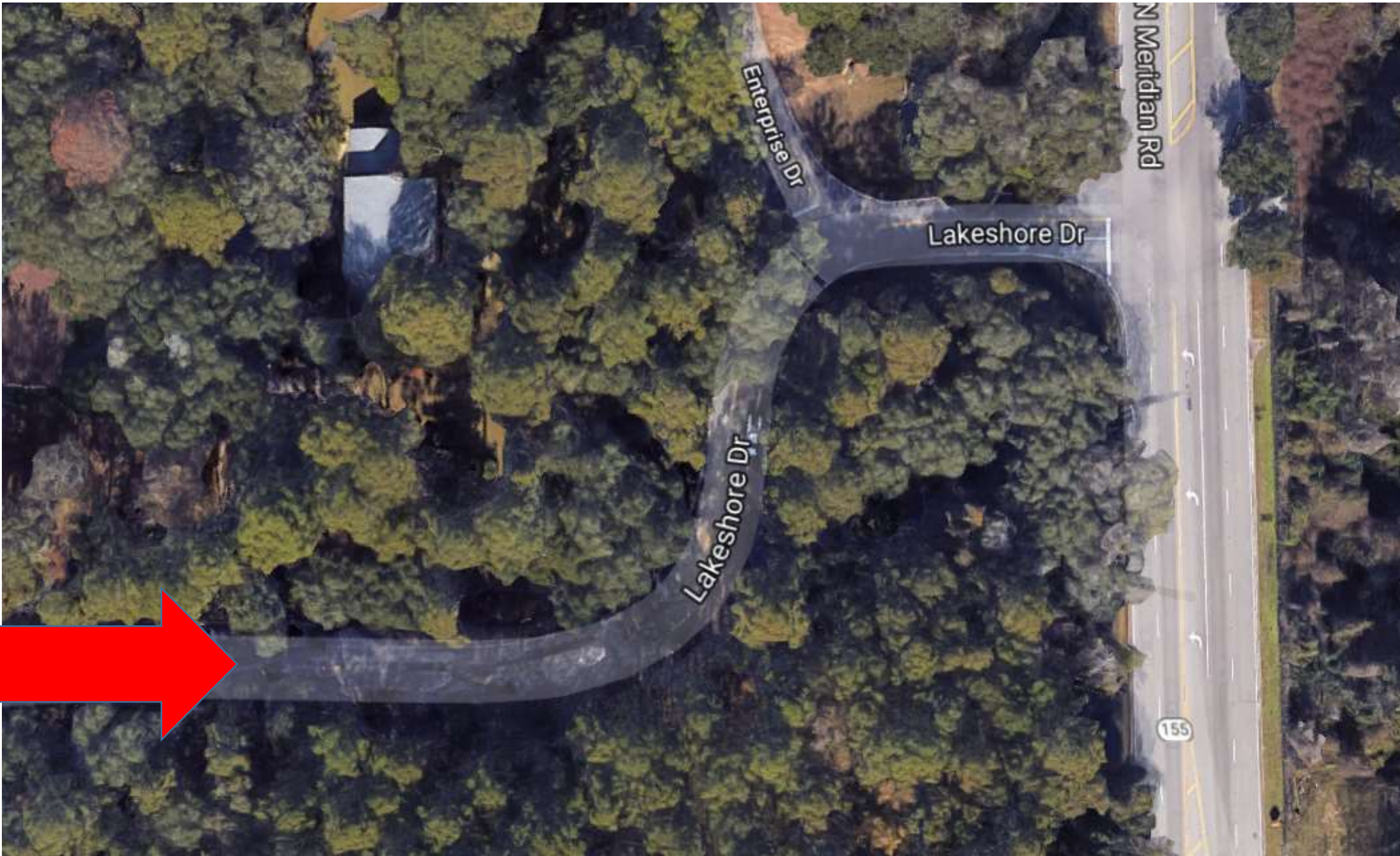


US 17, FL-GA Stateline

G - FINAL PROCESSING

- Authority's P.E./Designee
 - Review - completeness & Greenbook requirements
 - DDE/FHWA for concurrence (if applicable)
- Returned with Signatures to Responsible P.E.
 - Original to municipality/county
 - Copy to Department (if applicable)





Superelevation?



TO: Vincent S. Long
Leon Co. Administrator

DATE: 6/4/19

SUBJECT: ☐ DESIGN EXCEPTION or ☒ DESIGN VARIATION

Local road number or street name: Lakeshore Drive

Project description (limits): approximately Sta. 1259+11

Type construction (new, rehabilitation, adding lanes, resurfacing, etc.) resurf.

Design Speed 30 mph

State and/or Federal road number (if applicable): n/a (subdivision)

FDOT Financial Project ID No. (if applicable): n/a

DESIGN EXCEPTION OR VARIATION FOR THE FOLLOWING ELEMENT:

() Design Speed

() Lane Width

() Shoulder Width

☒ Horizontal Curve Radius

() Superelevation Rate

() Stopping Sight Distance

() Maximum Grade

() Cross Slope

() Vertical Clearance

() Design Loading Structural Capacity

() Other (explain):

- ☐ Shoulder Width
- ☐ Horizontal Curve Radius
- ☐ Superelevation Rate
- ☐ Cross Slope
- ☐ Vertical Clearance
- ☐ Design Loading Structural Capacity

I Include a brief statement concerning the project and items of concern.

Attach all supporting documentation to this exhibit in accordance with Chapter 14.

- | | |
|-----------------------------|--|
| () Shoulder Width | () Cross Slope |
| () Horizontal Curve Radius | () Vertical Clearance |
| () Superelevation Rate | () Design Loading Structural Capacity |

There have been NO crashes attributable to this deficiency in the most recent 5-years from 2014 to present. A Curve Warning sign with Advisory Speed Plaque and Chevrons will be implemented on the project. Due to ROW constraints, it is not feasible to increase the Curve Radius at this location.

◀ E DOCUMENTATION FOR APPROVAL OF DESIGN EXCEPTIONS

Supporting documentation that is generated during the approval process is to accompany each submittal. Design Exceptions should include the following documentation:

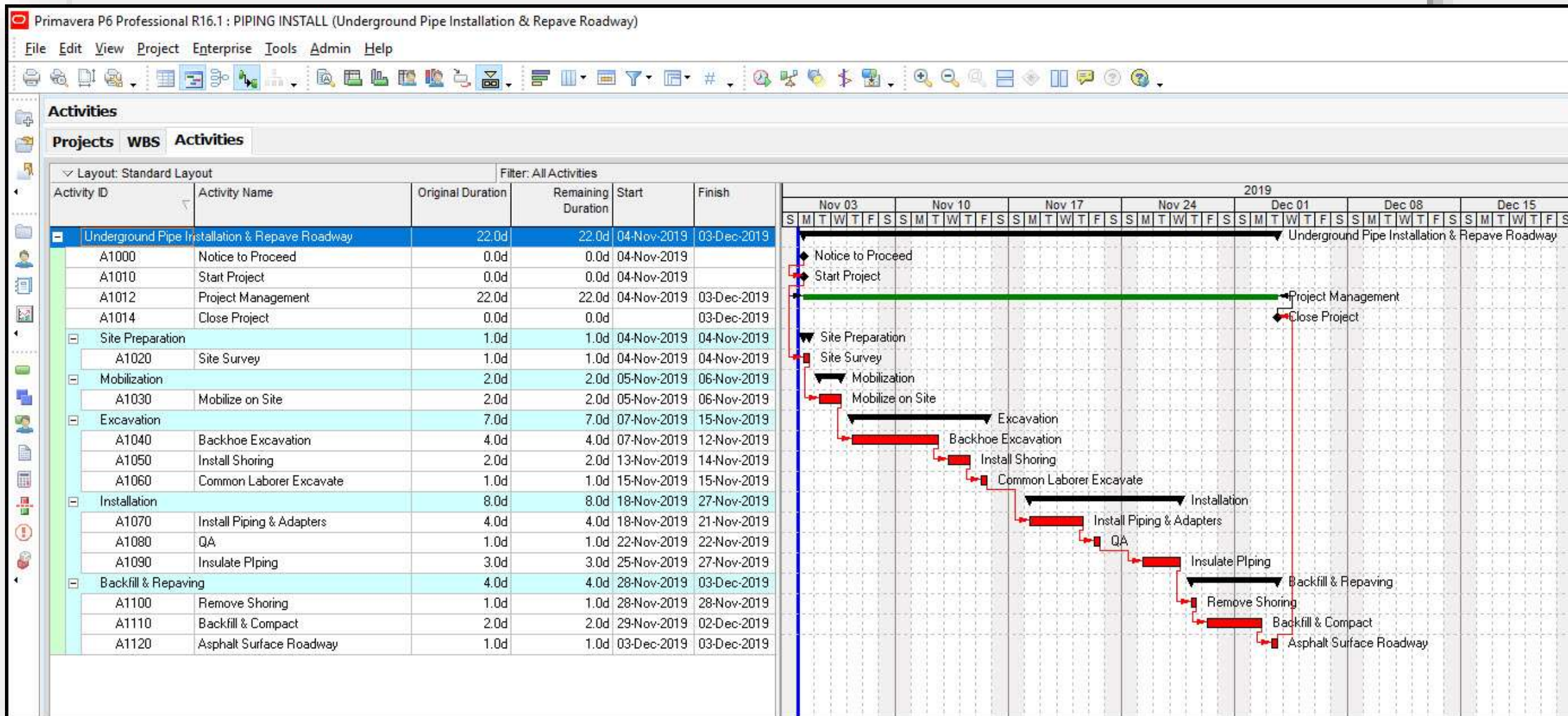
- ✓ 1. Submittal/Approval Letter (Example shown in Exhibit 14-A) *See Cover Page*
- ✓ 2. Project Description:
 - a) General project information, location map, existing roadway characteristics, project limits (mileposts), county section number, work mix, objectives, and obstacles.
 - b) Associated or future limitations that exist as a result of public or legal commitments.
3. Project Schedule and Lifespan:
 - a) Letting date and other important production dates associated with the project.
 - b) Discussion of whether the deficiency is a temporary or permanent condition.
 - c) Future work planned or programmed to address the condition.
4. Exception Description:

▶ E DOCUMENTATION FOR APPROVAL OF DESIGN EXCEPTIONS

Supporting documentation that is generated during the approval process is to accompany each submittal. Design Exceptions should include the following documentation:

- ✓ 1. Submittal/Approval Letter (Example shown in Exhibit 14-A) *See Cover Page*
- ✓ 2. Project Description:
 - a) Lakeshore Dr. is in Tallahassee. See Appendix A for (1) Location Map, and (2) Project Limits. The County Section Number is xyz; the Work Mix is resurfacing; Objective is to extend the life of the pavement; see b) below for project challenges.*
 - b) Commitment to Community to not disturb trees lining the roadway.*
3. Project Schedule and Lifespan:
 - a) Letting date and other important production dates associated with the project.
 - b) Discussion of whether the deficiency is a temporary or permanent condition.
 - c) Future work planned or programmed to address the condition.
4. Exception Description:

DOCUMENTATION FOR APPROVAL OF DESIGN EXCEPTIONS



c) Future work planned or programmed to address the condition.

No future projects planned.

Manual of Uniform Minimum Standards
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Revise ~~January 18, 2019, October 31 22 July 30 July 18 May 9, 2018~~

**Table 3 – 127 Minimum Radii (feet) for Design Superelevation Rates
Low Speed Local Roads ($e_{\max} = 0.05$)**

<u>e - ft/ft</u>	<u>Design Speed (mph)</u>							
	<u>10</u>	<u>15</u>	<u>20</u>	<u>25</u>	<u>30</u>	<u>35</u>	<u>40</u>	<u>45</u>
<u>0.05</u>	<u>16</u>	<u>41</u>	<u>83</u>	<u>149</u>	<u>240</u>	<u>355</u>	<u>508</u>	<u>675</u>
<u>0.045</u>	<u>16</u>	<u>41</u>	<u>85</u>	<u>152</u>	<u>245</u>	<u>363</u>	<u>520</u>	<u>692</u>
<u>0.04</u>	<u>16</u>	<u>42</u>	<u>86</u>	<u>154</u>	<u>250</u>	<u>371</u>	<u>533</u>	<u>711</u>
<u>0.035</u>	<u>16</u>	<u>42</u>	<u>87</u>	<u>157</u>	<u>255</u>	<u>380</u>	<u>547</u>	<u>730</u>
<u>0.03</u>	<u>16</u>	<u>43</u>	<u>89</u>	<u>160</u>	<u>261</u>	<u>389</u>	<u>561</u>	<u>750</u>
<u>0.025</u>	<u>16</u>	<u>43</u>	<u>90</u>	<u>163</u>	<u>267</u>	<u>398</u>	<u>577</u>	<u>771</u>
<u>0.02</u>	<u>17</u>	<u>44</u>	<u>92</u>	<u>167</u>	<u>273</u>	<u>408</u>	<u>593</u>	<u>794</u>
<u>0.015</u>	<u>17</u>	<u>45</u>	<u>94</u>	<u>170</u>	<u>279</u>	<u>419</u>	<u>610</u>	<u>818</u>
<u>0.01</u>	<u>17</u>	<u>45</u>	<u>95</u>	<u>174</u>	<u>286</u>	<u>430</u>	<u>627</u>	<u>844</u>
<u>0.005</u>	<u>17</u>	<u>46</u>	<u>97</u>	<u>177</u>	<u>293</u>	<u>441</u>	<u>646</u>	<u>871</u>
<u>0</u>	<u>18</u>	<u>47</u>	<u>99</u>	<u>181</u>	<u>300</u>	<u>454</u>	<u>667</u>	<u>900</u>



4.

Exce

a)

b)

c) F
a

d) F

e) T

f) M

5.

Alter

a) M
b



lines

no-

✓ 4. Exception Description:

- a) *For $e = 0$ ft/ft & $DS = 30$ MPH, Min. Radius = 300 ft.*
- b) *Existing-to-Remain Curve Radius = 120 ft.*
- c) *See Appendix A.*
- d) Photo of the area of the deficiency.
- e) Typical section or cross-section.
- f) Milepost or station location.

5. Alternative Designs Considered:

- a) Meeting AASHTO or Florida Greenbook criteria, partial correction, and the no-build (existing) condition.

✓ 4. Exception Description:

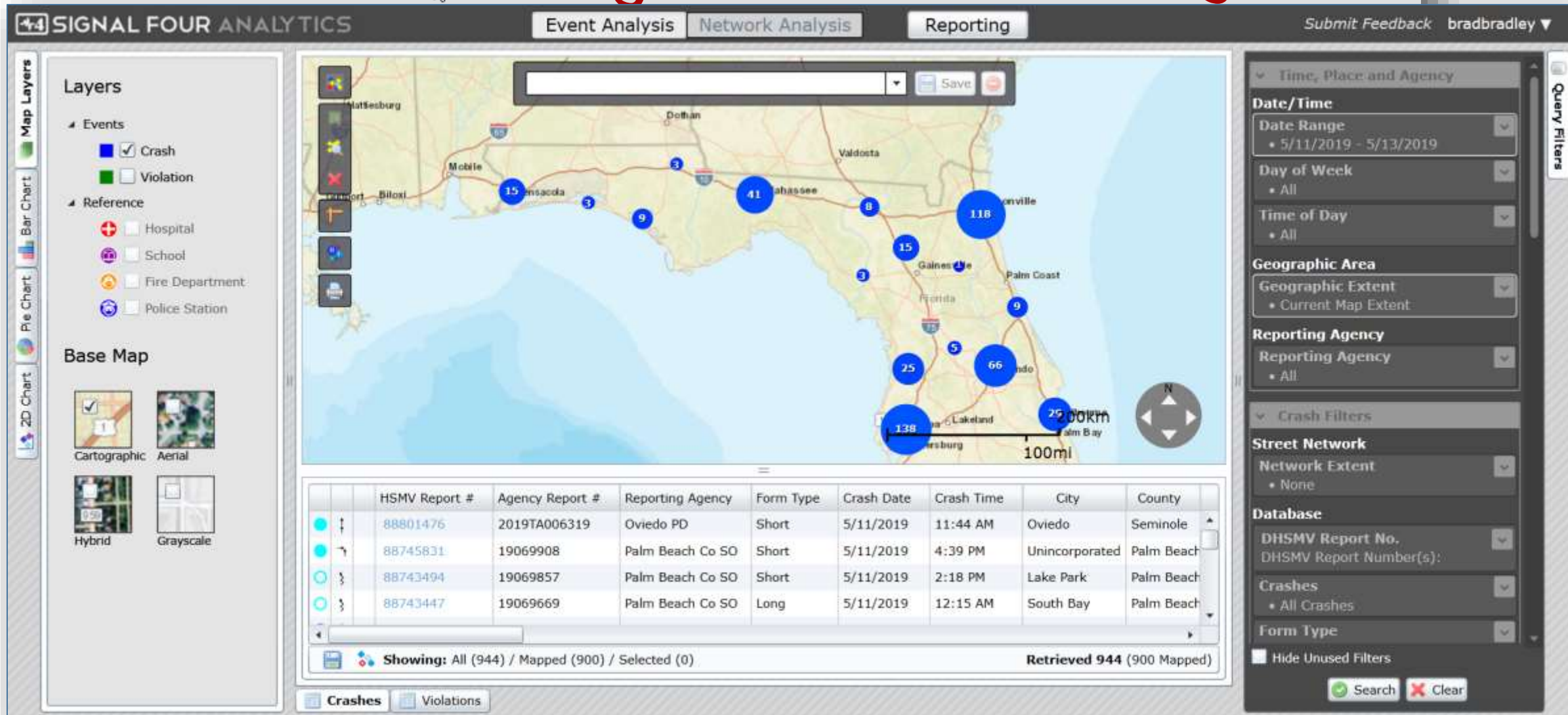
- a) *For $e = 0$ ft/ft & $DS = 30$ MPH, Min. Radius = 300 ft.*
- b) *Existing-to-Remain Curve Radius = 120 ft.*
- c) *See Appendix A.*
- d) Photo of the area of the deficiency.
- ➡ e) Typical section or cross-section.
- ➡ f) Milepost or station location.

✓ 5. Alternative Designs Considered:

- ➡ a) Meeting AASHTO or Florida Greenbook build (existing) condition.



✓ 6. Impacts of the Exception: *Signal Four Analytics*



➡ e) Environment

➡ f) Usability by all modes of transportation

- ✓ 7. Anticipated Costs:
 - I a) Description of the anticipated costs (design, right of way, construction, maintenance).
- 8. Mitigation Measures:
 - a) Practical mitigation measures or alternatives that were considered and any selected treatments implemented on the project.
- 9. Summary and Conclusions

When preparing a Design Exception, the Responsible Professional Engineer should consider potential mitigation strategies that may reduce the adverse impacts to highway safety and traffic operations. Please refer to the FHWA [Mitigation Strategies for Design Exceptions \(July 2007\)](#) for examples of mitigation strategies. The [Highway Safety Manual \(HSM\)](#) and [Highway Capacity Manual](#) provide information on quantifying and evaluating highway safety performance.



7. Anticipated Costs:

I

Provide the overall project estimate. Include here the B/C Ratio that captures the Cost Deltas between alternatives!

8. Mitigation Measures:

- a) Practical mitigation measures or alternatives that were considered and any selected treatments implemented on the project.

9. Summary and Conclusions

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A Curve Warning sign with Advisory Speed Plaque and Chevrons will be implemented on the project.

✓ 9. Summary and Conclusions

There have been NO crashes attributable to this deficiency in the most recent 5-years from 2014 to present. A Curve Warning sign with Advisory Speed Plaque and Chevrons will be implemented on the project. Due to ROW constraints, it is not feasible to increase the Curve Radius at this location.

