INSTRUCTIONAL MEMORANDUMS
To Local Public Agencies

Iowa Department of Transportation

To:	Counties and Cities	Date: October 1, 2013
From:	Office of Local Systems	I.M. No. 3.218
Subject:	Design Exception Process	

Contents: This Instructional Memorandum (I.M.) provides guidelines and procedures for a Local Public Agency (LPA) to prepare and request a design exception from the Iowa Department of Transportation (Iowa DOT). This process is required for Federal-aid and State-aid projects. This process may also be used as a guide for projects funded with local or Farm-to-Market funds only, but submittal to and approval by the Iowa DOT is not required. This I.M. also includes the following attachments:

Attachment A – Design Exception Process Flowchart

Step 1 – Determine the type of improvement.

Many factors are considered either directly or indirectly when determining the type of improvement. Some of those factors are:

1. *Pavement Condition* - The existing pavement condition and the scope of needed pavement improvements dictate, to a large extent, what improvements are practical. More significant geometric upgrading might be appropriate if the pavement improvements are substantial, but may not be appropriate or economical if the needed pavement improvements are relatively minor.

2. *Physical Characteristics* - The physical characteristics of a highway and its general location often determine what improvements are desirable, practical or cost-effective. Topography, adjacent development, existing alignment (horizontal and vertical) and cross-section (pavement width, shoulder width, side slopes, etc.) need to be considered in determining the scope of geometric or safety improvements.

3. *Traffic Volumes* - Traffic data (volume, percent trucks) are an important consideration both in the determination of the appropriate level of improvement (i.e., reconstruction vs. 3R) and in the selection of actual values for the various geometric elements.

4. *Functional Classification* - Drivers associate and expect certain geometric features and levels of design with each functional class.

5. *Traffic Control and Regulations* - Judicious use of special traffic regulations, positive guidance techniques (signs, markings) and traffic operational improvements can often forestall expensive reconstruction by minimizing or eliminating possible adverse safety and operational features of existing highways.

6. *Safety Enhancement* - Safety enhancement is an essential consideration for all proposed projects. Federal-aid 3R projects should be developed in a manner which considers appropriate safety improvements.

7. *Crash Records* - Evaluation of crash records may reveal problems requiring special attention and is an integral part of the project development process.

8. *Economics* - Economic considerations are a major factor in determining the priority and scope of work. This is especially true for 3R projects which, by definition, are to prolong and preserve the service life of existing highways and enhance highway safety, in order to protect the investment in and derive the maximum economic benefit from the existing highway system.

9. *Environmental and Social Impacts* - Projects are influenced by potential impacts on the surrounding land and development. Social, environmental, and economic impacts may limit the scope of projects. This is especially true for 3R projects where the existing right of way is narrow and there is adjacent development.

10. *Others* - Maximum benefit for the dollar invested, compatibility with adjacent sections of unimproved roadway, the probable time before reconstruction, and other items could be considered.

Step 2 – Determine if the proposed improvement meets current design guides.

For projects located on Primary or Interstate highways, and for projects located on the NHS, refer to the Iowa DOT Road Design Manual. For projects not located on Primary or Interstate highways, and for projects not located on the National Highway System (NHS), compare the proposed design with the design guidelines in I.M. 3.210, Rural Design Guidelines; I.M. 3.205, Urban Design Guidelines; and I.M. 3.214, 3R Guidelines, as applicable.

For the following design elements, if the proposed design does not meet the minimum recommended values in the design guides listed above, a formal design exception, including a benefit-cost analysis, will be required:

1. Design speed
2. Grade
3. Lane width
4. Stopping sight distance
5. Shoulder width
6. Cross slope
7. Bridge width
8. Superelevation
9. Structural capacity
10. Vertical clearance
11. Horizontal alignment
12. Vertical alignment
13. Horizontal clearance
14. Clear zone (only for rural cross sections with design speeds 40 mph or greater)

Other design elements that do not meet the minimum design guidelines should still be justified, but do not require a formal design exception or benefit-cost analysis. Such justifications should be based on sound engineering judgment, describe any proposed mitigation measures, and include any other supporting documentation that is appropriate.

Federal regulations also require approval of design exceptions for any new construction, reconstruction, or 3R project on the National Highway System (NHS), regardless of funding source. LPAs should review the design of all such projects and submit design exception requests to the Iowa DOT Administering Office. Routine maintenance activities on NHS routes do not require review or approval by the Iowa DOT.

If the proposed improvement does not meet the design guides and the LPA wishes to pursue a design exception, continue to Step 3. Otherwise, revise the project design to meet the design guides.

Step 3 – Analyze the crash data.

Crash data can be analyzed using the Crash Mapping and Analysis Tool (CMAT) software, which is available from the Iowa DOT Office of Traffic and Safety The crash data for at least the past 5 years should be reviewed. Review the crashes with respect to location, type, severity, contributing circumstances, environmental conditions, and the time period. It is often helpful to plot the crashes on a map of the roadway by location, severity, and possible type.

Roadway/environment contributing circumstances should receive special attention, but those crashes with driver/vehicle contributing circumstances should not be ignored. Even if a crash is the drivers fault (drunk, speeding, ran stop sign, etc.) you should look at possibly how the roadway environment (flatter slopes, stop ahead signs, etc.) may have lessened the severity of the crash.

It is also a good idea to get a copy of the actual crash report on the fatality crashes and the crashes involving a number of injuries or those classified as major injuries. These will provide you with additional information. You may want to review these with local law enforcement to their perspective. It could be beneficial to field check the locations of these high severity crashes and any locations which appear to have a high number of crashes or a high crash rate.

Step 4 – Prepare a cost estimate to bring deficiencies up to current guidelines.

This estimate should be based on upgrading the deficiency to the preferred design values; not to just the minimum design values. For bridge width design exceptions, assume a design loading no less than that of the bridge's original design.

This estimate does not need to be precise such as a complete redesign with exact quantities being determined. It can be based on the "average" conditions as in average cross section, average right of way needed, average number of culverts extensions per mile, average cubic yards of dirt per mile and the average price of homes, buildings, wells, etc.

Step 5 – Calculate the Benefit / Cost Ratio

Use the procedure outlined in I.M. 3.216, Economic Analysis (Benefit-to-Cost Ratio).

1. If the B/C is less than 0.80, then all that is needed is the B/C worksheet, crash data, and written justification stating the reasons for the exception, including a statement of whether there are any high crash locations and the proposed mitigation.

2. If the B/C is from 0.80 to 1.20, then the 6 additional items listed in I.M. 3.216 need to be addressed in addition to the material listed previously.

3. If the B/C is over 1.20, then the exception may not be granted unless there are extenuating circumstances. An extenuating circumstance may be that the severe crashes occurred at a certain location(s) and the LPA proposes an improvement(s) at this location(s) and without these crashes the B/C is below 0.80. Another extenuating circumstance may be that the LPA doesn't have sufficient funds to do the improvement in conjunction with the project but will program it in the near future.

Step 6 – Prepare a written design exception request.

Include the justification (reasons) and describe any proposed mitigation for the exception, as described below.

Justification: Consider addressing the following items, as applicable:

1. Pavement Condition

   Example: The LPA has 100 miles of Hot Mix Asphalt (HMA) pavement which requires resurfacing every 10 years to 15 years in order to maintain it. It is not feasible with present funding to reconstruct the roadway each time a resurfacing is needed. When the pavement requires more than a resurfacing, upgrading will be considered.

2. Physical Characteristics (extent of deficiency)

   Example: Although the foreslopes are 2:1, the ditch depths are less than 6 feet except for two locations. One of these locations will be treated with guardrail and the other is a short distance with no hazards located on the slope or in the ditch area.

3. Traffic Volumes

   Example: Although the traffic volume is over 750 vpd along this 5 mile stretch, the north 3 miles is less than 750 and the south 2 miles near town is in a built up area with houses close to the road. Since it would be cost prohibitive to purchase or damage these homes, the LPA will conduct a speed study in this area.

4. Functional Classification

   Example: This route carries, for the most part, local traffic between two communities and is not a through route in the county.

5. Traffic Control And Regulations

   Example: The County had installed chevrons at the two horizontal curves three years ago. The half mile north of the city is posted under a 45 mph speed zone.

6. Safety Enhancement (Seven Items in I.M. 3.214)

   Example: The bridge had guardrail installed and the bridge rail will be delineated according to the factor system in I.M. 3.213. All signs and markings will be in conformance with the current Manual on Uniform Traffic Control Devices (MUTCD). In checking the clear zone there is one culvert which will be protected with guardrail, and although the power poles between Stations 100+00 and 120+00 are within the clear zone, they are located as close to the right of way line as is practical.

7. Crash Records

   Example: There are no areas with a concentration of crashes and the crash rate is below the statewide average. The one fatality crash that occurred on this route was a head-on collision near Station 110+50 which is a flat stretch and the vehicles remained on the roadway after the crash. Therefore, the vertical curves and the 2:1 slopes did not enter into this crash and if this crash is not considered in the B/C calculations, the B/C ratio is less than 0.80.

8. Economics

   Example: To reconstruct the 15 degree horizontal curve will require either the purchase of a $120,000 house or the reconstruction and relocation of a 24' X 120' bridge. We plan to reconstruct the curve at the time the bridge is replaced in 5 to 10 years. Until then, curve sign with advisory speed plates and chevrons, will be installed along with the painting of edgelines.

9. Environmental or Social Impacts

   The environmental or social effects of the improvement should always be considered. These might include: farmland being taken out of production; relocation of families; adverse effect on wetlands or parks; and disturbance of historical or archaeological areas.

   Example: The crest vertical curve in question has a cemetery on one side and a church on the other side of the road. There have been no crashes at this location. The cemetery entrance is located at the top of the crest with plenty of sight distance and the church entrance will be relocated directly across from the cemetery entrance. The "no passing zone" markings and signs will be installed according to the MUTCD.

Proposed mitigation: Describe any proposed mitigation for the design exception. Examples of typical mitigation measures for various substandard design elements are shown below.

1. Horizontal curves
   - curve signs or turn signs
   - advisory speed plates
   - chevrons
   - edgelines

2. Vertical curves
   - no passing zone pennants
   - no passing lines at height of eye per MUTCD
   - edgelines
   - relocate entrances or advance crossing signs (W11 series)
   - relocated road intersections with limited sight distance or place crossroad sign (W2-1) or side road sign (W2-2), possible with advisory speed plates
   - animal signs (W11-3 & 4) with a history of animal crashes

3. Shoulders
   - edgelines

4. Slopes
   - edgelines
   - flatten slopes with ditch depths over 6' or a traffic barrier (w-beam or cable guardrail)
   - flatten driveway slopes

5. Grades
   - hill signs (W7-1), if needed, as determined by percent of grade and length

6. Narrow bridges*
   - guardrail
   - bridge rail upgrading
   - narrow bridge signs (W5-2, as per MUTCD guidance)
   - delineation
   - edgelines (for hard surfaced roads, these should extend at least 300 feet from all 4 corners of the bridge)
   - object markers

   * Narrow bridges are those with a roadway clearance less than the minimum design guidelines or less than the approach roadway width. Refer also to I.M. 3.213, Traffic Barriers (Guardrail and Bridge Rail), for guidance on whether guardrail or bridge rail should be added or upgraded.

7. Clear Zone
   - remove hazards
   - traffic barriers
   - relocate utilities as close to right of way line as possible

8. Combinations
   - speed study if a high crash rate
   - traffic barriers
   - spot reconstruction

Step 7 – Document the design exception in the project file.

For Federal-aid or State-aid projects, send the following to the Iowa DOT Administering Office:

1. Cover letter stating the exception(s)
2. Analysis of the crash history
3. B/C ratio
4. Reason(s) for the exception(s)
5. Proposed mitigation(s)
6. Copies of all documentation and supporting calculations (crash data, B/C worksheet, bridge rail sheet, etc.)

Step 8 – Review by the Iowa DOT.

For Federal-aid and State-aid projects, the Iowa DOT Administering Office will review the design exception request and notify the LPA whether the requested approved or disapproved. If disapproved, reasons will be provided.