Kentucky Method 64-114-1412
Revised 05/22/1406/15/12
Supersedes 64-114-1208
Dated 06/15/1207/24/08

CAMERA/VIDEO INSPECTION OF PIPE WITH ALTERNATE METHODS OF DEFLECTION MEASUREMENT

1. SCOPE: This method provides procedures for camera inspection of pipe and three methods of determining deflection: laser, mandrel testing, and physical measurements.

2. APPARATUS:

2.1. Camera Inspection Equipment: Provide a pipeline inspection camera having the following features:

- Configured properly in the pipe both vertically and horizontally, and having the ability to pan and tilt to a 90 degree angle with the axis of the pipe and rotate 360 degrees.
- Low barrel distortion camera.
- Color image with a minimum standard resolution of 720 x 480 pixels.
- Equipped with sufficient lighting to provide a clear image of the full circumference of the pipe.
- Capable of recording the station, milepost, distance along the invert of the pipe, or other indicators of location superimposed on the video.
- Capable of moving through entire length of pipe.
- Capable of measuring cracks greater than 0.1” and joint separations greater than 0.5”.
- Software capable of generating a report that shows each fault along with its location from the inspection entrance and a still frame image of the fault.

2.2. Laser deflection measuring device: For use on Corrugated Metal Pipe, High Density Polyethylene Pipe, and Polyvinyl Chloride Pipe up to 48 inches in diameter, provide a laser deflection measuring device capable of measuring deflection to an accuracy of 0.5% or better and a repeatability of 0.12% or better.

2.3. Mandrel: For use on Corrugated Metal Pipe, High Density Polyethylene Pipe, and Polyvinyl Chloride Pipe, use a mandrel device with an odd number of legs (9 minimum) having a length not less than the outside diameter of the mandrel. The diameter of the mandrel at any point shall not be less than the diameter specified in Section 3.6. Mandrels can be a fixed size or a variable size. The diameter of the mandrel, whether it is fixed or variable size, must be verified with a proving ring or other method as per the manufacturer’s guidelines.

2.4. Physical Measuring Tools: Use contact or non-contact distance instruments.

3. PROCEDURE:

3.1. Ensure pipe is clear of water, debris or obstructions. Complete the video inspection and any necessary measurement prior to placing the final surface over any pipe. When paving will not be delayed, take measurements 30 days or more after the completion of earthwork to within 1 foot of the finished subgrade. Notify the Engineer a minimum of 24 hours in advance of inspection And notify the Engineer immediately if distresses or locations of improper installation are logged.

3.2. Pipeline Video Inspection for Defects and Distresses:

3.2.1. Begin at the outlet end and proceed through to the inlet at a speed less than or equal to 30 ft/minute. Remove blockages that will prohibit a continuous operation.

3.2.2. Document locations of all observed defects and distresses including cracking, reinforcing steel showing, sags, joint offsets, joint separations, deflections, improper joints/connections, blockages, leaks, rips, tears, buckling, deviation from line and grade, and other anomalies not consistent with a properly installed pipe..

3.2.3. During the video inspection provide a continuous 360 degree pan of every pipe joint.

3.2.4. Identify and measure all cracks greater than 0.1” and joint separations greater than 0.5”.

3.2.5. Video Inspections are conducted from junction to junction which defines a pipe run. A junction is defined as a headwall, drop box inlet, curb box inlet, manhole, buried junction, or other structure that disturbs the continuity of the pipe. Multiple pipe inspections may be conducted from a single set up location, but each pipe run must be on a separate video file and all locations are to be referenced from nearest junction relative to that pipe run.

3.2.6. Record and submit all data as per Section 4.1.

3.3. Pipeline Laser Inspection for Deflection:

3.3.1. Calibrate the laser deflection measuring device according the manufacturers specifications. Provide all calibration data and applicable manufacturers recommendations for calibration and use to the Engineer.

3.3.2. Measure the deflection occurring at the point of the projected laser and at a minimum interval of 0.1 feet along the pipe.

3.3.3. All deflection measurements are to be based off of the AASHTO Nominal Diameters. Refer to Section 3.6.

3.3.4. Inspect at a speed that will provide proper data acquisition to effectively measure the maximum deflection. The inspection speed shall be less than or equal to 30 ft/minute.

3.3.5. Laser inspections are to be conducted in the same manner as Section 3.2.5.

3.3.6 Record and submit all data as per Section 4.2.

3.4. Mandrel Testing: Mandrel testing will be used for deflection testing if the video measurements are called into question or if limitations in the laser deflection measuring device are exceeded. Physical measurements as described in Section 3.5 may also be used in lieu of the laser or mandrel methods.

3.4.1. Use proving ring or other method recommended by the mandrel manufacturer to verify mandrel diameter prior to inspection. Provide verification documentation for each size mandrel to the Engineer.

3.4.2. All deflection measurements are to be based off of the AASHTO Nominal Diameters. Refer to Section 3.6.

3.4.3. Begin by using a mandrel set to the 5.0% deflection limit. Place the mandrel in the inlet end of the pipe and pull through to the outlet end. If resistance is met prior to completing the entire run, record the maximum distance achieved from the inlet side, then remove the mandrel and continue the inspection from the outlet end of the pipe toward the inlet end. Record the maximum distance achieved from the outlet side.

3.4.4. If no resistance is met at 5.0% then the inspection is complete. If resistance occurred at 5.0% then repeat 3.4.1 and 3.4.2 with the mandrel set to the 10.0% deflection limit. If the deflection of entire pipe run cannot be verified with the mandrel then immediately notify the Engineer.

3.4.5. Record and submit all data as per Section 4.3.

3.4.6. Care must be taken when using a mandrel in all pipe material types and lining/coating scenarios. Pipe damaged during the mandrel inspection will be video inspected to determine the extent of the damage. If the damaged pipe was video inspected prior to mandrel inspection then a new video inspection is warranted and supersedes the first video inspection. Immediately notify the Engineer of any damages incurred during the mandrel inspection and submit a revised video inspection report.

3.5. Physical Measurements: Alternate method for deflection testing when there is available access or the pipe is greater than 48 inches in diameter.3.5.1. Use a contact or non-contact distance instrument as per Section 2.4.1. A leveling device is recommended for establishing or verifying vertical and horizontal control.

3.5.1. Physical measurements may be taken after installation and compared to the AASHTO Nominal Diameter of the pipe as per Section 3.6. When this method is used, determine the smallest interior diameter of the pipe as measured through the center point of the pipe (D2). Take the D2 measurements at the most deflected portion of the pipe run in question and at intervals no greater than ten (10) feet through the run. Calculate the deflection as follows:

% Deflection = [(AASHTO Nominal Diameter - D2) / AASHTO Nominal Diameter] 100%

Note: The Engineer may require that preset monitoring points be established in the culvert prior to backfilling. For these points the pre-installation measured diameter (D1) is measured and recorded. Deflection may then be calculated from the following formula:

% Deflection = [(D1 – D2) /D1] (100%)

3.5.2. Record and submit all data as per Section 4.2.

3.6. AASHTO Nominal Diameters and Maximum Deflection Limits: These deflection limits are the maximum allowable deflection on any axis within the pipe and not just in the XY plane.

Base Pipe Diameter	AASHTO Nominal Diameter	Max. Deflection Limit		
		5.0%	7.5%	10.0%
(inches)	(inches)	(inches)		
15	14.76	14.02	13.65	13.28
18	17.72	16.83~~25~~	16.39	15.95
24	23.62	22.44~~49~~	21.85	21.26
30	29.53	28.05	27.32	26.58
36	35.43	33.66	32.77	31.89
48	47.24	44.88	43.70	42.52
54	53.15	50.49	49.16	47.84
60	59.06	56.11	54.63	53.15

4. REPORTING: Submit all recorded information to the Engineer on standard forms along with the complete video inspection on DVD in digital format. The forms included in this method shall be used for reporting the inspection information. Ensure all video pipe runs on the DVD have the station, milepost, distance into the drain or other indicators of location superimposed on the video. Submit two copies of the paper inspection report forms (one copy to the Section Engineer and one copy to Central Office Division of Construction), a copy of the DVD and one electronic copy of the report. All inspection reports shall be completed on the attached forms and shall be clearly named and organized in the electronic copy.

4.1. Pipeline Video Inspection Report: The Pipeline Video Inspection Report shall include the "Pipe Video Inspection Summary Report" form, the "Individual Pipe Video Inspection Report" form(s), and the report(s) generated by the inspection software for each pipe run.

4.1.1. Individual Pipe Video Inspection Report form: Complete Project Information, Inspector Information, and Pipe Information. Under Inspection Information record each defect/distress and joint along with its distance from the inspection entrance in feet and in sequence. Attach a copy of the report generated from the inspection software and reference the page number associated with the still image of the joint, distress/defect along with any additional information.

4.1.2. Pipe Video Inspection Summary Report form: This page is to be used as the cover sheet for the completed video inspection report. Complete Project Information, Inspector Information, and Pipe Information.

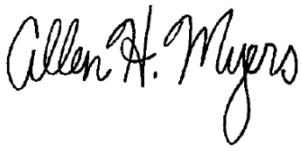
4.2. Pipeline Deflection Inspection Report: The Pipeline Deflection Inspection Report shall include the "Pipe Deflection Inspection Summary Report" form, the "Individual Pipe Deflection Inspection Report" form(s), and the report(s) generated by the inspection software for each pipe run. If using physical measurements, as per Section 3.5, then include a copy of all calculations.

4.2.1 Individual Pipe Deflection Inspection Report form: Complete Project Information, and Inspector Information. Under Inspection Information record each joint location along with the beginning and ending locations where the deflection exceeds 5.0%, 7.5%, and 10.0%. Attach a copy of any supportive information generated from the inspection software and reference the page number where more detailed deflection information may be conveyed.

4.2.2. Pipe Deflection Inspection Summary Report form: This page is to be used as the cover sheet for the completed deflection inspection report. Complete Project Information, Inspector Information, and Pipe Information.

Kentucky Transportation Cabinet
Division of Construction, 3rd Floor
200 Mero Street
Frankfort, Kentucky 40622

APPROVED



DIRECTOR
DIVISION OF MATERIALS

DATE 06/15/1205/22/14

Kentucky Method 64-114-1412
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Dated 06/15/1207/24/08

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INDIVIDUAL PIPE VIDEO INSPECTION REPORT

Project Information					
Project #:		**Item #:**		**Date:**	
District:		**County:**		**Route:**	

Inspector Information			
Inspecting Contractor:			
Operator Name:		**Operator Name:**	
Operator Name:		**Operator Name:**	

Pipe Information							
Inspection Date		**Installation Date**		**Begin Sta.**		**End Sta.**	
Pipe Diameter		**Pipe Material**		**Pipe Length**		**Inspected Length**	
Pipe Application Type		**Backfill Material**		**Embankment Height**			
Lining Type		**Under Pavement**					

Inspection Information			Inspection Information Continued		
Location	**Comment**	**Page**	**Location**	**Comment**	**Page**

PIPE VIDEO INSPECTION SUMMARY REPORT

Project Information					
Project #:		**Item #:**		**Date:**	
District:		**County:**		**Route:**	

Inspector Information			
Inspecting Contractor:			
Operator Name:		**Operator Name:**	
Operator Name:		**Operator Name:**	
Inspecting Contractor Signature:		**Date:**	

Pipe Information

Beginning Station	Ending Station	Dia.	Material	Length	Type	Under Pavement	Cracks > 0.1"	Joint Separations	Other	Pages

INDIVIDUAL PIPE DEFLECTION INSPECTION REPORT

Project Information					
Project #:		**Item #:**		**Date:**	
District:		**County:**		**Route:**	

Inspector Information			
Inspecting Contractor:			
Operator Name:		**Operator Name:**	
Operator Name:		**Operator Name:**	

Pipe Information							
Inspection Date		**Installation Date**		**Begin Sta.**		**End Sta.**	
Pipe Diameter		**Pipe Material**		**Pipe Length**		**Inspected Length**	
Pipe Application Type		**Backfill Material**		**Embankment Height**			
Lining Type		**Under Pavement**		**Calibration Method**			

Inspection Information			Inspection Information Continued		
Location	**Comment**	**Page**	**Location**	**Comment**	**Page**

PIPE DEFLECTION INSPECTION SUMMARY REPORT

Project Information					
Project #:		**Item #:**		**Date:**	
District:		**County:**		**Route:**	

Inspector Information			
Inspecting Contractor:			
Operator Name:		**Operator Name:**	
Operator Name:		**Operator Name:**	
Inspecting Contractor Signature:		**Date:**	

Pipe Information

Beginning Station	Ending Station	Date	Dia.	Material	Length	Type	Under Pavement	> 5%	> 7.5%	> 10%	Pages