

Zoom Inspection of Manholes
As provided by Inframatrix, LLC

1.0 General

- 1.0.1 This specification includes the requirements and procedures for inspecting and televising manholes via zoom technology using a wide-angle, truck mounted, telescoping boom zoom camera.
- 1.0.2 The crew consists of a supervisor who works inside the truck and a technician who works the back of the truck at the manhole.
- 1.0.3 The camera is used to record the condition of the manhole's frame, chimney, cone, walls, bench, invert and steps.
- 1.0.4 The camera pans as it is lowered to the bottom of the manhole to allow for a clear inspection of the wall, each joint and the bottom of the manhole.

2.0 Equipment Requirements

2.1 Camera

- 2.1.1 The camera shall have an optical zoom range: 25X (minimum)
- 2.1.2 The camera shall have a digital zoom range: 1X through 12X (minimum)
- 2.1.3 The camera shall have a total effective zoom ratio: 300X (minimum)
- 2.1.4 The camera shall be designed with the ability to pan the camera head 360 degrees continuously, tilt mechanically 35 degrees up from horizontal, tilt mechanically 90 degrees down from horizontal and tilt optically 166 degrees
- 2.1.5 The camera shall have auto focus and auto exposure features. In addition, the camera shall be capable of remote, real time, operator manual override and adjustment of focus and camera aperture operations.

2.2 Lighting

- 2.2.1 The camera shall contain high intensity discharge (HID) integral lighting
 - 1. Four camera mounted HID spot lights shall provide a total output equivalent to 200 watts of halogen light
 - 2. One camera mounted HID flood light shall provide a total output equivalent to 50 watts of halogen light
- 2.2.2 External light heads – The camera design shall allow the attachment of integral external light fixtures to provide additional light as needed in larger diameter pipelines. The external light attachments shall move in unison with the positioning of the camera assembly.
 - 1. The external lighting will consist of two quick disconnect external light head assemblies, each assembly consisting of two light heads on each side of

camera that are directional with the pan and tilt movements of the camera head.

2. The external light heads shall provide a total of 340 additional watts of light, 170 watts per light head assembly (minimum).

2.3 Truck Mounted Boom and Mast System

- 2.3.1 The truck-mounted mast shall be capable of positioning the camera 25 feet, or greater, below the surface of the road/ground.
- 2.3.2 The camera shall have the ability to be remotely raised and lowered using an electric winch controlling a self contained, telescoping mast assembly.
- 2.3.3 The boom and mast assembly shall provide sufficient horizontal (X – Y) positioning to optimize the camera alignment within the manhole.
- 2.3.4 The boom and mast assembly shall provide sufficient 360 degree mast pivot articulation to optimize the camera positioning within the manhole.
- 2.3.5 The boom and mast assembly shall provide sufficient locking capability to hold the camera steady in any desired position, without slipping or vibration, to assure clear and steady viewing and video recording during all camera operations.

3.0 Preparation

- 3.0.1 Assess traffic situation and implement traffic safety measures.
- 3.0.2 Use the appropriate field maps to locate and identify manholes. If there is a change to the configuration of the manhole or connecting pipeline, mark corrections to the field maps provided. Also, note the change appropriately and clearly in the data collection software being used.

4.0 Data Collection

- 4.0.1 Use the appropriate data collection software to capture and record information pertaining to the manhole. The use of data fields and formats consistent with MACP specification is recommended. At a minimum, the following information should be included:
 1. Manhole identification number
 2. Location of manhole using closest address and street name
 3. Inspection date and weather condition
 4. Type of manhole (sanitary, storm, combined, etc.)
 5. Manhole environment (abnormal features, detected gases, etc.)
 6. Surface type (asphalt, grass, etc.)
 7. Shape, dimension, material and type of cover, frame and chimney
 8. Rim height or depression from roadway surface measured by placing a straight edge over manhole frame

9. Material, depth and diameter of riser, extension rings
 10. Material and diameter of manhole barrel
 11. Material of bench, invert or floor
 12. Deficiencies observed on the ground surface, cover, frame, chimney, cone, walls, bench, invert and steps
 13. Presence and/or evidence of infiltration and/or inflow
 14. Additional connections to the manhole other than those indicated on the plan
 15. Look for the presence of lining and record type if applicable
 16. Validate function and sub-function of main sewer line
 17. Depth of flow
 18. Type and approximate depth of debris
 19. Approximate depths measured to all pipeline connection inverts from the rim
- 4.0.2 Video inspections will be recorded on electronic media in MPEG format video files, named and indexed for easy GIS retrieval.
- 4.0.3 Photos of major observed defects will be captured in JPEG format.

5.0 Field Procedures

5.1 General

- 5.1.1 Remove manhole cover and move it away from traffic flow without impacting work area. If cover is defective, place so it can be viewed by camera and recorded. Notify the Owner if a manhole cover is broken or cracked.
- 5.1.2 Position the inspection vehicle to position the camera over the manhole for optimal camera movement for inspection.
- 5.1.3 Position a surveyor's elevation rod into the manhole. Place the elevation rod in front of the outgoing pipe but as far from the camera as possible. The rod will be used for rotation and depth reference during inspection so it should be touching the bottom of the channel for accuracy.
- 5.1.4 The camera head should pan until it is facing in the direction of the downward pipe. Reset rotation reader to 0.0. No video recording should occur during this procedure.
- 5.1.5 Lower the telescopic boom to where the camera head is approximately 1 foot above frame and ground surface. No video recording should occur during this procedure.
- 5.1.6 The camera mounted single flood light should be powered on during the following inspection procedures.
- 5.2.2 5.1.7 Tilt camera head down to 90 degree angle to document the entire manhole as a top down view. Begin video recording of the manhole once the camera has

been positioned and shows a clear top down view. Lower the telescopic boom if necessary to obtain a clear picture of the entire manhole and pipe configuration. Wait until the Manhole Identification Q-card has been recorded (first 6 seconds). The top down view shall have a minimum duration of five (5) seconds. Continue recording.

- 5.1.8 If a defect is found at any point in the inspection, the camera must be positioned, as appropriate, and held in place to document the defect for a minimum of 5 seconds. In all cases, the camera pan will be stopped and zoom capability used to inspect any defect or abnormality observed.

5.2 Cover, Frame and Chimney Area

- 5.2.1 The camera mounted single flood light should be powered on during the following inspection procedures.
- 5.2.2 Position the telescopic boom to where the camera head is approximately 1 foot above the frame and ground surface. Adjust the camera head angle to 30 to 45 degrees below horizontal and perform a 360 degree inspection of the manhole showing the cover and pavement surrounding the manhole frame.
- 5.2.3 The camera should be positioned and adjusted to 0-15 degrees to closely view the frame/chimney joint area. Care should be taken to adjust the camera angle to assure a detailed view of the entire joint area.
- 5.2.4 Once a 360 degree inspection is completed, the camera should remain at 0 to 15 degrees as the camera is lowered to the next inspection point within the chimney area. Do not pan camera as it is lowered and the rod measurements should be visible onscreen as the camera is lowered. It may be necessary to offset the rod to the side of the picture to reduce glare and improve clarity.
- 5.2.5 Lower the camera in one (1) foot intervals according to the rod while in the chimney area. A 360 degree rotation is considered starting from the rod and ending at the rod.

5.3 Cone and Wall Area

- 5.3.1 The camera mounted single flood light should be powered on during the following inspection procedures.
- 5.3.2 Once the camera is lowered into the cone area, the angle can be adjusted to 25-30 degrees to obtain a detailed view of the cone area.
- 5.3.3 For manholes with concrete walls, every joint will require a 360 degree inspection. Ideally, the camera should be positioned so that any joint is in the center of the viewed area.

- 5.3.4 For brick manholes, the manhole should be inspected 360 degrees every 2 feet on the measuring rod.
- 5.3.5 Care should be taken to assure that the entire surface of the manhole is viewed with the camera. A slight overlap of area between vertical adjustments is preferable.
- 5.3.6 For manholes with slab type cones, the camera will be lowered past the slab, camera tilted upward to allow the inspection of the underside of the slab. The camera should be lowered sufficiently so minimal shadows are created.

5.4 Bench and Channel Area

- 5.4.1 The camera mounted single flood light should be powered on during the following inspection procedures
- 5.4.2 At the bottom of the manhole (two feet indicated on the rod), the camera will be positioned to allow inspection of pipe connections, inverts and bench using the same 30 to 45 degree angle until the camera is facing the outlet manhole. The camera should be paused at each pipe connection and the entire visible area of the pipe connection should be viewed in detail.
- 5.4.3 If additional lighting is required for the inspection of this area, the 4 camera mounted spot lights can be powered on to allow inspection of the channel in one final pan. Care should be taken to assure that glare from the light does not obscure the video. The inspection will be finalized with the camera facing the outlet of the manhole. Recording can then be stopped.
- 5.4.4 If connecting pipelines are to be inspected along with the manholes, then refer to section 5.0 Field Procedures in the *Zoom Inspection of Pipelines* specification.

5.5 Equipment Removal

- 5.5.1 After the recording has stopped, all connecting pipeline diameters should be verified with the measuring rod and the zoom camera.
- 5.5.2 Upon completion of the manhole inspection, raise telescopic boom to remove camera from the manhole and turn off lights once camera is safely out of manhole.
- 5.5.3 Remove loose dirt, stones and other foreign material from the mating surface of the rim before replacing the manhole cover. Replace manhole cover ensuring that the cover is seated properly. Adjust if necessary. If cover cannot be seated correctly, make a notation on manhole log and inform Owner of location.
- 5.5.4 Secure camera and boom, pick up traffic control devices and proceed to next manhole.

5.5.5 If a critical service (blockage) or structural (cracked/broken cover, collapsing wall) condition is found, notify Owner immediately of condition and location.

6.0 Zoom Data Evaluation

6.0.1 Following the completion of the field data gathering, the videos shall be reviewed by qualified technicians to record the defects. Priority grades shall be assigned to all defects using the NASSCO MACP or other appropriate manhole assessment and grading system.

7.0 Related Specification

7.0.1 Refer to the Specification for *Zoom Inspection of Pipelines* for zoom inspection of connecting pipelines.