



SACRAMENTO AREA SEWER DISTRICT

TELEVISION INSPECTION MANUAL

The use of this Television Inspection Manual is the sole responsibility of the agency using it. The practices described in this manual are intended as guidance and need to be evaluated and tailored for site-specific needs and conditions of each agency and system, as well as any mandatory regulatory requirements.

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Section 1

TVI Procedure

100 TVI PROCEDURE

This section describes Television Inspection (TVI) performance standards, contractor submittal requirements, TVI quality standards, TVI submittal standards, TVI Equipment Standards, inspection procedure, narration requirements, and special TVI procedures.

101 TVI PERFORMANCE STANDARDS

The purpose of a TVI is to clearly record and assess the condition of an asset.

TVI performance includes the following:

- Consistent use of standard forms and codes
- Uniform compliance with setup and inspection procedures
- Quality picture and audible records
- Suitable camera speed, lighting, and panning
- Accuracy when recording file names and electronic data

Systematic procedures for performing TVIs vary depending on the type of system inspected (sewer main line, node, or lower lateral), the camera equipment and accessories, and the computerized data collection system. However, some basic procedures need to be followed to obtain TVI data. The following sections summarize these procedures and the Standards required by Sacramento Area Sewer District (SASD). The information provided in this manual is intended to *supplement* project specific contract documents that bind a contractor performing this work for SASD.

102 TVI QUALITY STANDARDS

102.1 COUNTER CALIBRATION

Calibrate the footage counter for the camera at least every 2 weeks during TVI operations. The footage counter must be accurate to 0.5%. Perform calibration by checking the cable counter against a measured length of 400 feet for mainline cameras. The inspector must verify the date of the last calibration before every TVI project.

102.2 VERIFICATION OF MAP LENGTH

Wheel footage is required for all main lines. Calibrate the measuring wheel every 2 weeks along with the TV footage counter. When measuring the pipe length, take into account the topography of the ground surface and the alignment of the sewer.

102.3 LIGHTING

Illuminate the pipe to minimize glare. Adjust lighting as needed, according to pipe size, to provide a clear picture of the entire periphery of the pipe for all conditions encountered.

102.4 CAMERA TRAVEL SPEED

The camera travel speed must be a uniform rate of no more than 30 feet per minute (fpm) for main line inspections and 15 fpm for lower lateral inspections. Camera travel must stop to record features and defects.

102.5 CLARITY

All video and still picture images must be clear and sharp. Adjust the focus, iris, zoom, and lighting as needed to obtain a satisfactory image. The recorded image from the TVI camera must be free of fog or haze in the pipe. If the camera lens becomes obscured with condensation, grease, or debris, remove the camera from the pipe then clean and reinsert it to continue inspecting the pipe.

103 PROJECT SUBMITTAL STANDARDS

103.1 SAMPLE VIDEO AND TVI SUBMITTAL

For TVI contractors performing inspection for SASD, sample videos are required for review by SASD. The sample videos must represent the quality of video inspection and electronic data the contractor will provide. Contractors must submit the requested number of complete sample inspections demonstrating compliance with the Standards and Scope of Work of the project for SASD to review and approve before continuing inspection work on the project.

103.2 NONCONFORMING TVI STANDARDS

If the quality, content, or any other aspects of the inspections are not in compliance, SASD will reject the submittal, and the contractor will re-inspect or revise the inspection at their own expense. SASD will reject all inspections not in compliance.

103.3 NARRATION STANDARDS

All TVI video recordings are part of SASD permanent records and must not contain inappropriate language, idle chatter, background noise, and discussions between the operator and other crewmembers. All video must have audible narration. Narrate all defects and coded observations.

104 MEASUREMENT AND PAYMENT

The cost of each TVI and inspection must be all-inclusive and must be included in the price paid per linear foot of pipe, or as specified in project specific contract documents.

Payment for TVI work which is not required as part of construction work for rehabilitation must be made on an actual inspected lineal footage basis per diameter of pipe inspected and must include the cost of all items necessary to complete the TVI including bypass pumping or flow control which may be required.

No direct payment must be made for TVI services required as part of a construction work for rehabilitation. Payment for TVI must be included in the contract bid prices for the related rehabilitation items.

105 TVI SUBMITTAL FORMATS

105.1 SOFTWARE

SASD uses Granite.Net software for capture of TVI data. All contractors submitting main line, node, or lateral launch TVIs for review and acceptance of work must use Granite.Net software. All TVIs submitted for review and acceptance must be compatible with the version of Granite.Net currently in use by SASD.

The contractor is responsible for upgrading their system to provide compatibility with SASD system. Inspections must follow SASD configuration standards and be exported according to specific direction provided by SASD.

Refer to the Scope of Work for project specific requirements.

105.2 VIDEO FORMAT

Acceptable submittal formats include:

- Mpeg1
- Mpeg2
- Mpeg4

Inspections must be in Granite.Net format. Each asset must have its own inspection. Name files in accordance with Granite.Net formatting.

Acceptable Submittal Media includes:

- SacDrive
- External Hard Drive
- USB Flash Drive
- CD or DVD

106 TVI EQUIPMENT STANDARDS

TVI equipment includes all equipment, including accessories, attachments, programs, and power supplies necessary to perform, record, and submit a TVI in accordance with this section. It is the contractor's responsibility to ensure that all operators have the knowledge and ability to use all equipment correctly. It is the contractor's responsibility to ensure that all equipment required to perform work for SASD is operational, and conforms to the specifications detailed in this manual.

106.1 MAIN LINE AND NODE CAMERA

Use a camera designed and constructed specifically for sewer environments. The camera must include a color video camera with a panning, tilting, and rotational camera head, remote adjustable optical focus, and automatic light compensation iris with remote override, auto centering control, and camera lighting system.

The camera must be able to produce a minimum resolution of 640 x 480 focal distance must be adjustable. Size the camera mount for each pipe diameter to be inspected.

Do not make modifications to the camera that compromises the view in any way.

106.2 LOWER LATERAL CAMERA

Use a camera specifically designed and constructed for sewer environments. The camera head must be self-leveling. The camera must be able to record audio narration. The camera must provide an image resolution of 648 x 488 or better. The camera must be able to inspect 100' of lower lateral.

Do not make modifications to the camera that compromises the view in any way.

107 INSPECTION PROCEDURE

107.1 DISPLAY REQUIREMENT

- All displays will show

- Date and time format month/day/year (MM/DD/YYYY)
- No multiple dates or multiple times shown on video screen
- All font has to be white with no background

107.2 HEADER INFORMATION

This section covers the information and standard formats and codes required to complete the TVI header in Granite.Net, which is entered before conducting the TVI. The header information contains the date and time of the TVI and information about the inspection location, operator conducting the TVI, and pertinent data about the pipe inspected.

Use the following guidelines when completing the TVI header:

- Unless specifically required, do not enter units or abbreviations for measurements (e.g. in, “,ft, ‘)
- Enter all numeric entries to one decimal place, unless otherwise directed
- If the TVI extends through a node and spans more than 1 pipe segment, a new header form must be completed at the start of each subsequent pipe segment

Complete the header information in the field to provide as much information as possible about the inspection work. The table below includes a list of basic header information required for a TVI and provides an explanation of appropriate responses to each item.

TABLE 107.2: GRANITE.NET HEADER INFORMATION

Information Label or Field Name	Appropriate Sample Responses	Description/Comments
Start Date/Time	8/8/2013 07:34 PM	Time of day using 12-hour clock MM/DD/YYYY
ID	320-167-2005	GRID Number
Project Name	SASD TV 2017	Granite.Net Project Name
Operator	DOEJ or Vendor ID	Vendor or Employee performing inspection
Upstream Node	320-167-1021	Upstream Node GRID Number
Downstream Node	320-167-1020	Downstream Node GRID Number
Direction	With the Flow	Either with or against flow
Diameter	18	In inches
Location	SSS	Street or Easement

Information Label or Field Name	Appropriate Sample Responses	Description/Comments
Pipe Material	VCP	Pipe material (see abbreviations)
Purpose	CA	Condition Assessment
Comments/Summary		Add MAIN LINE Grid #, indicate other pertinent information, such as if pipe was plugged during TVI, whether pipe was cleaned prior to, during, or after TVI, last PM date, reason if inspection was abandoned. Also indicate wheeled length if segment length was measured.

107.3 DIGITAL DATA FORMAT

The video files generated within Granite.Net must use the Granite.Net default MPEG format.

107.4 MAIN LINES

The operator must verify footage counter accuracy before starting the TVI. The camera set point (footage counter set point) must be from the center of the node to the focal point in the direction of camera travel.

Immediately before inserting the camera into the structure, provide the following information as white text on the video recording. Display this text for approximately 15 seconds or for the duration of the start-up narration, whichever is longer:

- Purpose of the TVI
- Location
- Date and time of day
- Project name or work order number
- TVI contractor or SASD staff
- Operator's name

107.4.1 DIRECTION OF CAMERA TRAVEL

The camera must travel in the direction of flow in the pipe unless there are access problems that require a reverse set-up, the camera cannot pass through the pipe from end-to-end in the direction of flow, or because an obstruction prevents the camera passing. Reverse set-ups for convenience are not acceptable. Record all TVI observation distances based on the direction of camera travel.

Inspect main lines from upstream nodes to downstream nodes whenever possible, except for flusher branches and stubs. All main lines inspected against the flow direction must be noted “Against the Flow (U)” to indicate a reverse setup on the TVI Report.

During the TVI, the running screen must include the following information; the display of this information must in no way obscure the central focus of the pipe inspected:

- Running footage (distance traveled)
- Upstream and downstream grid numbers

The “zero” point of the TVI is the centerline of the node where the camera is inserted. Set the footage counter by adding the footage from the centerline of the node to the edge of the structure plus the camera length or the camera length plus the camera focal length.

The end point of the segment is the centerline of the node at the opposite end of the pipe segment from the starting node. Record this end point for approximately 15 seconds.

If a TVI set-up passes through a structure not shown on the sewer maps, record a structure centerline observation code at the footage location of the new structure. At the same footage location, create an “X” code with a modifier of “OTH” to annotate an unknown structure has been found. Do *not* start a new TVI record.

The camera must travel at a maximum speed of 30 fpm with slowdowns at joints. The camera must stop and pan or tilt as needed to observe, code, and clearly identify the following:

- Centerline – Center of Node both at the upstream and downstream sections
- Lower laterals that discharge into the main line
- Start Line – The point of transition between Node and the pipe
- Camera Set Point
- Lower laterals (tap)
- Joint separation (gap)
- The first 2 joints outside the Node – Not required for “Existing Assets”
- Offset joints
- Alignment problems and elbows
- Cracked or damaged pipe including lined or point repaired pipe
- Debris in the main line

- Identifiable sags or high points in the main line
- Root intrusion
- Inflow or infiltration
- Grease
- Corrosion
- Material Changes
- Diameter Changes
- End of main line – End of the pipe at the Node wall

107.4.2 INTERRUPTION OF PROGRESS

If the camera becomes stuck or otherwise cannot progress, evaluate, report, and, if possible, correct the cause of the interruption. If the camera cannot pass in a main line TV, use a reverse set-up, if possible, to complete the TVI. If pipe cleaning is required before resuming the TVI, recording of TVI observations must continue at 0.1 foot beyond the position where the TVI was interrupted. Narrate a comment regarding the cleaning and include it in the data record.

107.5 NODES

A node inspection is a separate inspection from a main line inspection. If a manhole is accessed to perform a TVI of a main line, a manhole TVI shall also be performed. For new facilities, the recording begins at the street surface or existing grade. This recording location is not required for existing facilities. Record node joints and service taps from the center of the node, ensuring the footage counter is set at 0.0.

Measure all footages from the focal point of the camera. The inspection ends at the base of the node barrel.

The operator must verify the footage counter accuracy before starting the TVI. The footage counter must appear on the screen at all times. The camera must stop and pan or tilt as needed to observe and clearly identify the following:

- Rim – The Node rim
- Lower laterals (tap)
- Joint separation (gap)
- Node taps
- Cracked or damaged barrel including repairs
- Debris in the Node
- Root intrusion
- Inflow or infiltration
- Grease
- Corrosion

- Diameter Changes
- Flow Channel or Node bottom
- Broken or plugged drops

107.6 LOWER LATERALS

Perform lower lateral inspections from the top cleanout to the main line or node, or from the main line or node tap (if available) to the easement or right-of-way line. Each individual lower lateral requires a separate inspection record and video.

Before placing the camera in the cleanout, pan around for a minimum of 15 seconds to show the cleanout relative to any buildings or property lines.

During the TVI, the running screen must include the date, the time, and the running footage (distance traveled). The “zero” point must be at the top of the cleanout or tap where the camera is inserted. Do *not* show defect codes on screen text.

The display of this information must be at the top of the screen. The camera must travel at a maximum speed of 15 fpm with slowdowns at joints. The camera must stop as needed to identify the following:

- Top of Cleanout
- Any upper lateral connections into the cleanout
- The elbow or wye transition between cleanout riser and the lower lateral pipe
- Joint separation (gap)
- Offset joints
- Alignment problems and elbows
- Cracked or damaged pipe including lined or point repaired pipe
- Debris in the lateral
- Identifiable sags or high points
- Root intrusion
- Inflow or infiltration
- Water Levels
- Grease
- Corrosion
- Material Changes
- Diameter Changes
- Tap type at main line or Node

The end point of the lateral is the inside face of the main line or node for normal set-ups and the easement or right-of-way line for reverse set-ups. Record this end point for approximately 15 seconds.

The camera must stay on to capture the video of the entire lateral while being pulled back at 15 fpm to the starting point of the inspection.

107.6.1 INTERRUPTION OF PROGRESS

If the camera becomes stuck or otherwise cannot progress, evaluate, report, and, if possible, correct the cause of the interruption. If pipe cleaning is required before resuming the TVI, recording of TVI observations must continue at 0.1 foot beyond the position where the TVI was interrupted. If lateral is a node tap, complete the inspection from the node. Narrate a comment regarding the cleaning procedures and include it in the data record.

108 NARRATION REQUIREMENTS

The TVI video recordings are part of SASD permanent records and must not contain inappropriate language, idle chatter, background noise, or discussions between the operator and other crewmembers. All video must have narration. Narrate all defects.

108.1 MAIN LINE NARRATION

Include a voice narration in the video recording. This narration must include the following information at the beginning of each asset inspection.

- Upstream and downstream grid numbers
- Direction of camera travel
- Type (main line) and purpose of inspection
- Date
- Work order number (if applicable) and project name
- Pipe size
- Pipe material
- TVI company or SASD staff name

Narrate all observations along the length of the pipe with a description of the observation and clock position, if applicable as follows:

- “Tap at 10 o’clock at 56 feet; factory wye”
- “Severe roots at 23 feet, all around crown of pipe”
- “Medium Solids at flow line starting at 45 feet”... “End Solids at 85 feet”

At the conclusion of the inspection of a pipe segment, the operator must state the final TVI footage and indicate that the TVI of the pipe segment is complete. For example:

- “TVI of sewer main line from node 382-172-1037 to node 382-173-1010 is complete at 214 feet”

If the inspection was abandoned before reaching the end, then a statement to this effect must be made as part of the ending narration with a reason given as to why the inspection could not be completed.

108.2 NODE NARRATION

Include a voice narration in the video recording. Include the following information at the beginning of each inspection:

- Node grid number
- Type (node) and purpose of inspection
- Date
- Work order number (if applicable) and project name
- Barrel material
- TVI contractor or SASD staff name

Narrate all observations along the length of the node, with a description of the observation and clock position, if applicable as follows:

- “Tap at 10 o’clock at 6 feet; inside drop”
- “Severe roots at 8 feet, all around barrel”
- “Medium grease in channel”
- “Mainlines entering node”

At the conclusion of the inspection of a node, the operator must state the TVI of the node is complete. For example:

- “TVI of node 382-172-1037 is complete”

If the inspection was abandoned before reaching the bottom of the node, then a statement to this effect must be made as part of the ending narration with a reason given as to why the inspection could not be completed.

108.3 LOWER LATERAL NARRATION

Include a voice narration in the video recording. Include the following information at the beginning of each asset inspection:

- Lateral grid number
- Direction of camera travel
- Type (lateral) and purpose of inspection
- Location (address)
- Date
- Work order number (if applicable) and project name
- Pipe size
- Pipe material
- TVI contractor or SASD Staff Name

Narrate all observations along the length of the pipe, with a description of the observation and clock position, if applicable as follows:

- “Upper lateral connection at 3 feet”
- “Number 6 roots at 15 feet”
- “Medium solids at flow line starting at 19 feet”
- “End solids at 23 feet”

At the conclusion of the inspection of a lateral, the operator must state the final TVI footage and indicate that the TVI of the laterals is complete. For example:

- “TVI of lower lateral is complete at 28 feet”

If the inspection was abandoned before reaching the end, then a statement to this effect must be made as part of the ending narration with a reason given as to why the inspection could not be completed.

109 SPECIAL TVI PROCEDURES

109.1 BURIED NODES

If a buried node is encountered, attempt to TVI through the node or conduct the TVI in the reverse direction and immediately notify SASD that the node needs to be exposed for future access. If it is not possible to TVI through the node, immediately notify SASD that the node needs to be exposed in order to complete the assigned TVI.

109.2 FLOW CONTROL

Perform flow plugging or bypass pumping in accordance with SASD Standards and Specifications.

The flow level requirements for TVI vary depending on the type of inspection performed. Generally, the more pipe is visible, the more data that is obtained. Lower amounts of visible pipe wall may be allowed depending on site conditions and with SASD approval.

For successful TVI, the depth of flow at the upstream manhole must be within the recommended limits for pipe sizes given below:

- 6 inch to 10 inch pipe: 0% to 20% of pipe diameter
- 12 inch to 24 inch pipe: 0% to 25% of pipe diameter
- 27 inch and up pipe: 0% to 30% of pipe diameter

When depth of flow is greater than recommended above, reduce the flow by plugging, or by pumping and bypassing the flow.

For new construction, nearly 100% of the circumference of the pipe wall must be visible. Introduce a small amount of water for purposes of sag identification.

109.3 LARGE DIAMETER PIPES

Large diameter pipes (approximately 36 inches and larger) often require special procedures for flow control, lighting, and camera travel. Often self-propelled camera rigs are not suitable for large diameter pipes and the camera must travel down the pipe on a float. Only TVI crews with the appropriate equipment and training to perform large diameter pipe inspection should do so.

109.4 NEW CONSTRUCTION

For new assets, perform a TVI to document that the new facilities are in compliance. Perform a TVI after all other testing has been completed to SASD's satisfaction, and before placing AB road base or finished improvements within the sewer easement.

Conduct a TVI before all new main line acceptances. The TVI will document and verify the following:

- The condition of the main line
- The location of service taps
- Line and grade
- Cleanliness

Before the TVI, sufficiently clean the main line, including all appurtenances, according to Section 330, "Pipe Cleaning" in the SASD Standards, except when performing a TVI to evaluate the as-is condition of the pipe.

Use the inspection (header) information and coding system described in the current version of the Television Inspection Manual.

Perform a TVI after all required testing specified is satisfactorily completed. The contractor will perform a separate TVI on each node and each main line.

SASD requires 20% or more, at discretion of inspector, of the lower laterals per project to be TV inspected to verify conformance with these Standards.

The inspector will make a visual inspection of each node after it has passed the testing requirements and is in its final condition. The inspection determines the completeness of the node; correct any defects to SASD's satisfaction before starting the TVI.

The contractor must coordinate with the inspector, who has been through SASD TVI Training, and will be on site to witness the entire TVI. If an SASD trained inspector is not available, one of the two following situations must apply:

1. If the main line installation contractor is doing the TVI, an inspector must be present. SASD may request an alternate inspector.

2. If the main line installation contractor is not doing the TVI, the TVI contractor will verify, on the TVI video, water introduction into the pipe system, and verify the target size with a tape measure.

The project inspector must fill out the top portion of the TVI form and give it to the TVI contractor to submit with the TVI data.

If the TVI is witnessed, the inspector must fill out the TVI Form in full.

Grid Numbers

SASD assigns SASD Grid Numbers to each node, main line, and lateral asset. Nodes shown on an overall plan and the inspected segments are tied to these assigned numbers. Grid numbers cannot be obtained until the facilities are in the ground and the project inspector has signed the “OK TO SUBMIT FOR GRID NUMBERING” signature block on the plans. The TV contractor must make an appointment with SASD at least 5 days before the TVI to obtain the plan with grid numbers and the most current SASD asset database for download on TV contractor’s vehicle. At the time of the appointment, the TV contractor will submit for verification the cover sheet of the plans with the project inspector’s signature reflecting the actual installation to the following address:

**Sacramento Area Sewer District
10060 Goethe Road
Sacramento CA 95827**

Private systems are not assigned SASD Grid Numbers or reviewed for electronic compliance by SASD.

109.4.1 WATER INTRODUCTION

Before performing a TVI on new construction, the contractor will introduce enough water in the pipe segment(s) to fill all low sections and flow through the downstream node. Use a 3/4 inch target for pipes up to 12 inches. Use a 1-inch target for pipes between 15 and 36 inches. If any section of the pipe segment appears to be dry, introduce additional water as described above. The SASD Inspector will verify the adequacy of water and target size before performing the TVI. The TVI will begin within 30 minutes of introducing water into the pipe segment.

Nonconforming TVI

If the quality of the video recordings are not in compliance, the contractor will reinspect or revise the segment at their expense. SASD will reject all inspections not in compliance.

Section 2

Observation Codes

200 OBSERVATION CODES

This section describes the codes used to record observations of asset features and defects identified during TVI. Included are general information and guidelines for using the observation codes, followed by listings of the codes, severity ratings, and other required information for each type of observation and a description or picture of each observation.

201 DEFINITIONS, GENERAL INFORMATION, AND GUIDELINES

201.1 CODES AND MODIFIERS

Observation codes used by SASD consist of several characters that designate something specific such as SP for “Solids in Pipe” or NTP “Type of Node” access structure at the end of a pipe. Most codes also have a modifier that denotes either the severity of a defect or a characteristic of the item. For example, a pipe with a severe rating for solids is given the following notation: SPS.

201.2 DEFECT RATINGS

Most defect observations are assigned a severity rating, or on the conservative side when judging severity:

- “L” (light or minor)
- “M” (medium or moderate)
- “S” (severe or heavy)

Roots are rated on a scale of 1 to 9, representing the relative portion of the cross sectional area that is blocked.

Water level is assigned an alphabetic rating based on the depth of water in the pipe.

Grease and water level are also assigned an “N” rating if no grease or water is present.

Observations that are not defects, but pertain only to sewer features, (e.g. node, flusher branch, tee, tap, change in pipe material) do not include a severity rating.

201.3 MULTIPLE DEFECTS

Record multiple features or defects at a single location as separate observations located at the same footage location. For example:

A pipe may have a severe radial crack (CPS) at the location of hammer tap (TPH at 2 o'clock) with No. 5 roots seen in the lower lateral (RPTP 5) that are protruding into the

main line and blocking 25% of its cross sectional area (RP3). This would require four separate entries at the same footage location.

If a defect such as roots or infiltration is observed at the same footage location as a crack, protruding tap, or other structural defect, both defects must be recorded at the same footage location. In this case, it is assumed that the roots or infiltration is entering the pipe through the structural defect. Recording every observed defect is important to assess the condition of the pipe.

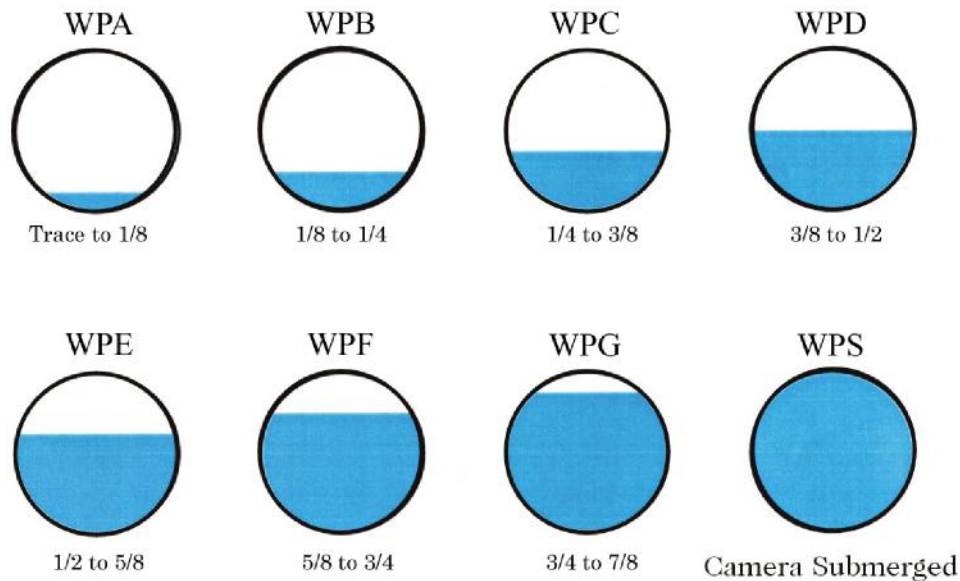
201.4 PIPE TYPE ABBREVIATIONS

Type of Pipe	Abbreviation
Acrylonitrile butadiene styrene	ABS
Asbestos cement pipe	ACP
Brick	BRK
Concrete cylinder pipe	CCP
Cast iron pipe	CIP
Cement mortar lined coated steel	CML
Corrugated metal pipe	CMP
Poured-in-place concrete	CON
Cured-in-place pipe	CPP
Corrugated steel pipe	CSP
Ductile iron pipe	DIP
Fold and form PVC	FFP
Fiberglass reinforced pipe	FRP
High-density polyethylene pipe	HDPE
PVC or PE-lined RCP	LRC
Non-reinforced concrete pipe	NCP
Orangeburg pipe	ORG
Polyethylene pipe	PEP
Plastic-lined pipe	PLP
Polyvinyl chloride pipe	PVC
Polyvinyl chloride spiral pipe	PVS
Reinforced concrete box	RCB
Reinforced concrete pipe	RCP
Reinforced plastic mortar pipe	RPM
Steel pipe	SP

Truss pipe	TP
Unknown	UNK
Unreinforced concrete	URC
Vitrified clay pipe	VCP
Vitrified segmented duct	VSG
Wooden pipe	WOD

201.5 WATER LEVEL

Enter the water level using the coding which designates depth in relation to the inside pipe diameter.



201.6 ROOTS, INFILTRATION, GREASE, AND OFFSET JOINT SUBCATEGORIES

There are two subcategories for roots, infiltration, grease, and offset joints:

1. The defect observed in the lower lateral, node or main line (RP, IP, GP, or OJ), and
2. The defect observed from the main line in the lower lateral (RP_TP, IP_TP, GP_TP, or OJ_TP).

For example: if roots are observed within the lower lateral during a main line TVI, use the code RP_TP and rate the roots according to the percentage of the lower lateral cross section that is obstructed. If the roots also intrude into the main line, then record the code RP, and rate the roots based on the percentage of the main line cross section that is obstructed by the roots coming from the lower lateral.

If infiltration is observed coming from a joint, crack, hammer tap connection, or other place in the lower lateral or main line, use the IP code. If infiltration (i.e., an obvious stream of clear water) is observed in a main line inspection discharging from the lower lateral into the main line, or is seen coming through a joint or crack in the lower lateral, then use the IP_TP code with a modifier. Record grease and offset joints in the lower lateral in a similar fashion.

201.7 COMMENTS

Minimize comments when identifying defects and only use them in atypical situations such as foreign material found in the pipe, or as otherwise indicated in the code explanations later in this section.

Examples of appropriate comments are:

- “Fence post protruding into top of pipe”
- “Pipe cleaned during TVI by (insert contractor or SASD) due to heavy grease”

201.8 CONTINUOUS DEFECTS

Continuous defects are defects or observations that extend more than 1 foot from beginning to end. A continuous defect can be one of the following code types:

- Sediment or solids (SP)
- Cracked pipe (CP) – typically longitudinal or spiral cracks extending more than 1 foot

Do not record any other observation codes as continuous.

Start recording a continuous defect at the footage location where the defect or observation begins. Record the “end” (E) of the defect at the footage location where the defect or observation ends. If the severity of the continuous defect changes, record a new entry with the appropriate severity.

Record defects that occur at regular intervals along the length (e.g. at each joint) but are not truly continuous as individual observations at each location where the defects occur.

Examples of these types of defects include:

- Roots at joints
- Open or displaced joints
- Circumferential fractures occurring at joints

Enter other features or defects observed at the same location as the start or end of continuous defect or within the footage spanned by the continuous defect in the usual manner separately from the continuous defect.

201.9 CLOCK POSITION

All blind tee (BT) and lower lateral connection observations (taps) must also include a clock position indicating the relative position of the pipe or lower lateral connection.

201.9.1 PIPES

The clock position for pipes is based on the camera pointing in the direction of travel, with “12 o’clock” at the crown (top) of the pipe. The clock numbers (e.g. 1, 2, 3) go in a circle in a clockwise direction around the circumference of the pipe.

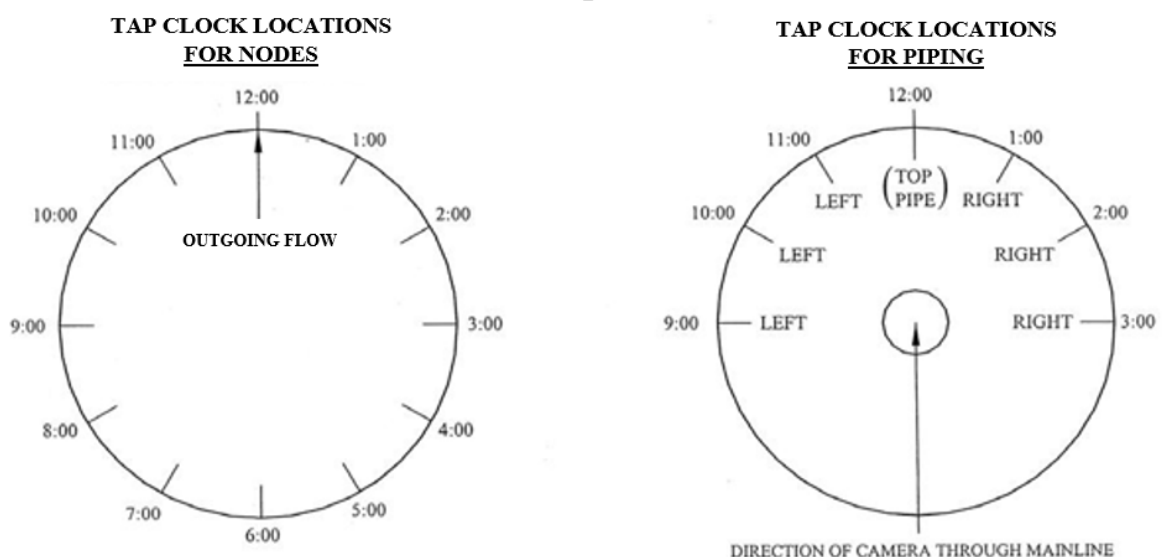
For example: a lateral discharging into the left-hand side of the main line pipe (based on camera travel direction) about 30 degrees above the spring line (horizontal centerline) of the pipe would be in the “10 o’clock” position. See **Figure 201.1**.

201.9.2 NODES

The clock position for taps into nodes is based on the direction of TVI of the associated pipe. When looking into the node from the surface, “12 o’clock” is the location of the outgoing pipe. The clock numbers (1, 2, 3, etc.) go in a clockwise circle (from right to left) around the circumference of the node chamber.

For example, a lower lateral discharging into a node on the right side of the node (when facing in the direction of the camera travel in the pipe) and at right angles to the pipe being inspected would be at the “3 o’clock” position. See **Figure 201.1**.

FIGURE 201.1: CLOCK POSITION FOR TAPS AND TEES



202 OTHER

Use the other (OTH) modifier to denote locations where the camera starts and stops or some problem not covered by another code is found.

202.1 SANITARY TEE

Use the sanitary tee (SANT) modifier at point where the UL connects to the vertical portion of the LL.

202.2 BOTTOM OF WYE

Use the bottom of wye (BOW) modifier at the point where the riser connects to the horizontal portion of the LL.

202.3 CENTERLINE OF NODE

Use the centerline of node (CL) modifier at the beginning and end (if the ending point is a node) of the main line TVI, or if a new node that is not shown on the sewer map is found during TVI. The code indicates the centerline of the node.

FIGURE 202.1: OTHER - CENTERLINE OF NODE



202.4 START AND END OF LINE

Use the OTH modifier for main line inspections. The start of line (SL) code indicates the interface of the starting node wall and the pipe. This footage is equal to half the diameter of the node. The end of the pipe at the node wall is typically the point where the camera footage counter is stopped using the end of line (EL) code. Record the footage at the ending node centerline as the EL footage plus half the diameter of the node.

202.5 START LATERAL AT CLEANOUT

Use the start lateral at cleanout (SLCO) modifier for lower lateral inspections that start at the cleanout. The point of entry into the lateral pipeline is at the top of the cleanout.

202.6 START LATERAL AT POINT OF DIG UP

Use the start lateral at point of dig up (SLDU) modifier for lower lateral inspections that start at a dig up. This is the point of transition along a lateral where a hole has been made in the lateral.

202.7 START OR END LATERAL AT NODE

Use the start lateral at node (SLMH) modifier for lower lateral inspections that start at a node. Use the (OTH) code and end of line (EL) modifier for lower lateral inspections that end at the point of transition between a node and the lateral, typically at the node wall.

202.8 START OR END LATERAL AT MAIN LINE

Use the start lateral at main line (SLML) modifier for lower lateral inspections that start from a main line. Use the (OTH) code and end of line (EL) modifier for lower lateral inspections that end at the main line.

202.9 CAMERA SET POINT

Use the camera set point (CS) modifier to identify the location where the camera footage counter is set typically about 5 to 8 feet into the pipe from the node. The camera set point is typically equal to half the diameter of the node plus the camera length, assuming that the camera cable harness bullet at the back end of the camera is placed at the interface of the node wall and the pipe.

Some TVI operators may establish the set point based on the camera length plus focal length. Either method is acceptable as long as the recording of observation footages is consistent (either at the head of the camera or at the focal point, depending on how the set point was established). The operator must estimate the footage locations of observations made before the camera set point.

202.10 OUTSIDE DROP

Use the outside drop (OD) modifier to identify a drop connection into a node with the drop piping located outside of the node barrel. Indicate the size and type of pipe connection, if known.

202.11 OTHER

Use the other (X) modifier for significant defects or features encountered in the pipe that are not otherwise described by another observation code. Examples include:

- A lining defect, which may appear as a bulge
- A missing section
- Separation from the wall
- A large obstruction
- Upper lateral root intrusion

Provide a description of observed defect.

203 TAP RELATED CODES

Use these codes to describe tap conditions and defects.

203.1 NODE TAP TYPE

Represent the type of node access structure at the end of a pipe by an NTP code. Use the NTP code with the following modifiers in Table 203-1 to identify the actual type of access structure found at the end of a pipe segment:

TABLE 203.1: NODE TAP MODIFIERS

Modifier/Severity	Definition
FB	Flusher Branch structure at the upstream end of the pipe that ends at ground level.
FDS	Flow Diversion Structure access at the end of the pipe
FMV	Flow Meter Vault access structure at the end of the pipe
GFV	Gravity Flow Valve access structure at the end of the pipe
JS	Junction Structure access at the end of the pipe
MH	Node access structure at the end of the pipe
MH_C	Node access structure that serves as a cleanout
SPHSTR	Siphon structure access at the end of the pipe
TEE	Pipe structure node with no direct access from ground level (no structure at the surface)

203.1.1 FLUSHER BRANCH

Use the flusher branch (FB) NTP code modifier when the TVI ends at a cleanout or flusher branch. Enter this code at the centerline of the flusher branch elbow or at the bottom of the flusher branch riser if connected by a wye or tee fitting. Record the total TVI length as the footage at the centerline of the elbow in the case of a flusher branch with elbow, or at the plug or end of the wye, tee, or stub main line, if there is a stub main line attached to the flusher branch wye or tee. Also, record all taps in the flusher branch or end of stub main line. Enter the flusher branch grid number and type of riser connection (e.g. elbow, wye, or tee, with or without stub main line.)

203.1.2 BLIND TEE OR WYE

Use the blind tee or wye (TEE) NTP code to identify a pipe junction node where two main lines meet without node access.

203.2 TAP TYPE




Use these codes to identify the location of lower lateral connections.

TPF	Factory tap	Wye or tee lower lateral connection to main line
TPC	Cored tap	Cored lower lateral connection to main line
TPH	Hammer tap	Lower lateral connection hammered into the main line
NODET	Node tap	Lower lateral connection into a node

Record taps using the Tap Type (TP) observation with a modifier that describes the type:

- A factory wye or tee (TPF)
- Cored tap (TPC)
- Hammer tap (TPH)

Record the appropriate clock position in the “clock from” position field of the observation.

Example Photo	Code	Modifier/ Severity	Item	Description
	TP	F	Factory tap	Wye or tee lower lateral connection to main line
	TP	C	Cored tap	Cored lower lateral connection to main line
	TP	H	Hammer tap	Lower lateral connection hammered into the main line

203.3 TAP STATUS

For main line inspections, enter the tap status (TS) code with one of the following modifiers:

- A (active)
- P (plugged with concrete, clay, or other physical plug)
- U (unknown)

Enter the clock position of the connection relative to the circumference of the pipe.

203.4 TAP DEFECT (PROTRUDING TAP)

Use the tap defect (TD) codes if a hammer tap lower lateral connection protrudes into the main line.

Example Photo	Code	Modifier / Severity	Item Description
	TD	PL	<u>Light Protrusion</u> Lower lateral protrudes no more than 10% into main line (no more than about 1/2" in a 6" or 8" pipe)
	TD	PM	<u>Moderate Protrusion</u> Lower lateral protrudes more than 10% but no more than 20% into main line (1/2" to 1" in a 6" or 8" pipe), but camera can pass
	TD	PS	<u>Severe Protrusion</u> Lower lateral protrudes more than 20% into main line (more than 1" in a 6" or 8" pipe), and camera cannot pass




204 PIPE OBSERVATIONS

Use these codes to document features or defects observed along the length of the pipe.

204.1 HORIZONTAL BEND

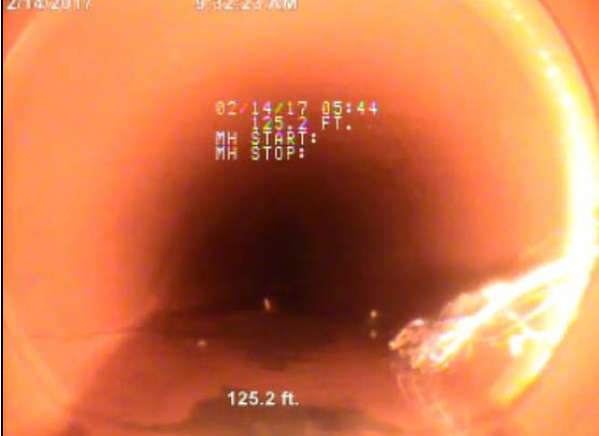

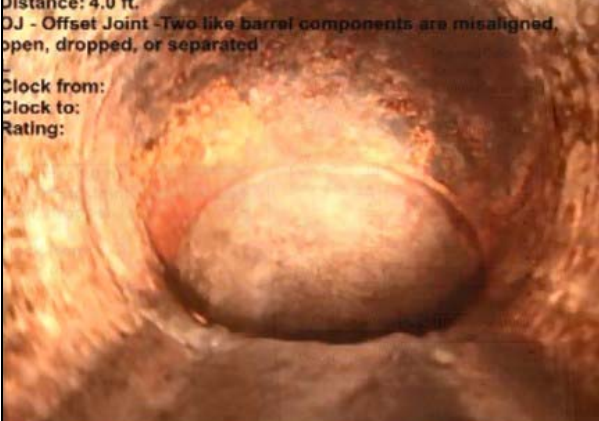
Use the horizontal bend (BH) code if the pipe turns or bends to the right or left without a node. The bend may be due to an installation problem, a designed curve, or a factory elbow installed without a node.

Code a horizontal bend more than 1 foot long with a new severity level at the location where the horizontal bend ends or changes in severity. Indicate the direction of the bend (right or left, as seen in direction of camera travel). Note if the bend is due to a factory elbow.

Example Photo	Code	Modifier / Severity	Item Description
	BH	L	<p><u>Horizontal Bend</u> <u>Light</u></p> <p>Slight curve in horizontal alignment</p>
	BH	M	<p><u>Horizontal Bend</u> <u>Medium</u></p> <p>Obvious curve in horizontal alignment or elbow</p>
	BH	S	<p><u>Horizontal Bend</u> <u>Severe</u></p> <p>Significant curve in horizontal alignment or factory elbow</p>

204.2 VERTICAL BEND

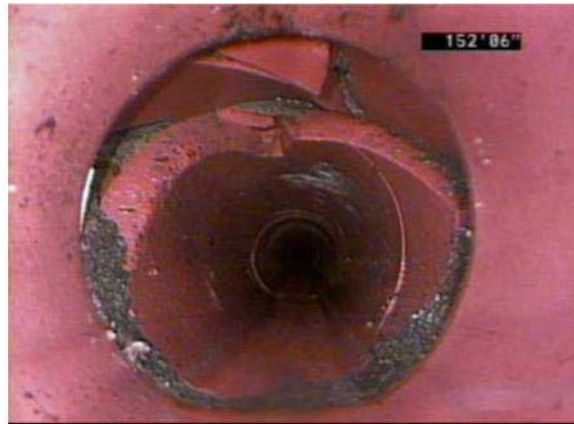
Use the vertical bend (BV) code if the pipe has a vertical curve in the alignment.

Example Photo	Code	Modifier / Severity	Item Description
	BV	L	<p><u>Vertical Bend Light</u></p> <p>Slight curve in vertical alignment</p>
	BV	M	<p><u>Vertical Bend Medium</u></p> <p>Obvious curve in vertical alignment or elbow</p>
<p>Distance: 4.0 ft. OJ - Offset Joint - Two like barrel components are misaligned, open, dropped, or separated Clock from: Clock to: Rating:</p> 	BV	S	<p><u>Vertical Bend Severe</u></p> <p>Significant curve in vertical alignment or factory elbow</p>

204.3 BROKEN PIPE OR HOLE IN PIPE

Use the broken pipe or hole in pipe code (BP) to indicate where a pipe or main line has a piece of wall visibly displaced or missing. This includes concrete or metal pipe with sufficient corrosion to create a hole in the pipe wall. If the severity is X, ***immediately*** report this pipe to SASD.

FIGURE 204.3: BROKEN PIPE (BPX)



204.4 LOSS OF STRUCTURAL INTEGRITY




Use the loss of structural integrity code (XP) when the pipe has fallen in, collapsed, or lost its structural integrity. If the severity is X, ***immediately*** report this pipe condition to SASD.

FIGURE 204.4: LOSS OF STRUCTURAL INTEGRITY (XP)






204.5 CORROSION

Use the corrosion code (CR) for concrete, asbestos cement, or metal pipes that show evidence of corrosion. Describe severe corrosion, e.g. rebar ribs showing, exposed rebar, rebar gone.

Example Photo	Code	Modifier / Severity	Item Description
 <p>61-01-7-U</p>	CR	L	<p><u>Corrosion, Light</u></p> <p>Yellow staining, softening of interior surface, wear and tear (concrete); light scaling of pipe wall (metal)</p>
 <p>38-21-11-U</p>	CR	M	<p><u>Corrosion, Medium</u></p> <p>Exposed aggregate (concrete), or moderate scaling, rust; flaking of pipe wall (metal)</p>
	CR	S	<p><u>Corrosion, Severe</u></p> <p>Rebar ribs showing, exposed rebar, or rebar gone (concrete); thickening of or material peeling off pipe wall (metal)</p>

204.6 OFFSET JOINT



Use the offset joint code (OJ) when the spigot of the pipe is not properly aligned with the bell of the adjacent pipe. Joints may be misaligned horizontally or open, dropped, or separated. Note in comments if joint gasket is visible, hanging, torn, or gone.


Example Photo	Code	Modifier / Severity	Item Description
	OJ	L	<u>Offset Joint, Light</u> Joint misaligned by $>1/4$ and $<1/2$ wall thickness
	OJ	M	<u>Offset Joint, Medium</u> Joint misaligned by $1/2$ to full wall thickness
	OJ	S	<u>Offset Joint, Severe</u> Joint misaligned by $>$ wall thickness or open, dropped, or separated

204.7 GREASE IN PIPE

Use the grease in pipe code (GP) at the beginning of the TVI and at locations where the grease level noticeably changes. Use the grease code at the start of the pipe and at all changes in grease ratings throughout the length of pipe.


If severe grease is encountered that requires pipe cleaning during the TVI, then the comments must indicate that the cleaning was completed, and a new grease rating must be entered at 0.1 foot after the location where the TVI was resumed after cleaning.



Example Photo	Code	Modifier / Severity	Item Description
 A photograph looking down a pipe with a thin, light-colored layer of grease coating the walls. A distance marker '300' 07"' is visible in the lower right.	GP	L	<u>Grease, Light</u> Thin layer of grease at flow line or on pipe walls
 A photograph looking down a pipe with a thicker, more irregular layer of grease. Text '8" VCP' is in the upper left, and '3173 BELVEDERE AV 061003004 -> 061003003' is in the lower left. A distance marker '326' 05"' is in the lower right.	GP	M	<u>Grease, Medium</u> Medium layer of grease that may distort flow

	GP	S	<p><u>Grease, Severe</u></p> <p>Thick layer of grease that alters flow or could result in stoppage</p>
	GP	N	<p><u>No Grease</u></p> <p>No visible grease</p>

204.8 INFILTRATION IN PIPE


Use the infiltration in pipe code (IP) for infiltration into the pipe at joints, cracks, or other defects. If the infiltration is occurring at a pipe defect (e.g. crack or offset joint), the defect code (e.g. CP, OJ) must also be recorded in addition to the IP code. If the infiltration originates from inside the lower lateral, the IP_TP plus the severity should be recorded for main line inspections.



Example Photo	Code	Modifier/ Severity	Item Description
	IP	L	<p><u>Infiltration In Pipe, Light</u></p> <p>Infiltration, dampness or water seeping</p>




	IP	M	<p><u>Infiltration In Pipe,</u> <u>Medium</u></p> <p>Water dripping</p>
	IP	S	<p><u>Infiltration In Pipe,</u> <u>Severe</u></p> <p>Severe water running or gushing</p>




204.9 ROOTS IN PIPE

Use the roots in pipe (RP) code when roots intrude into pipes at joints, cracks, or other defects. If roots occur at over an extended length of pipe, then record each root occurrence. If roots are encountered that require cleaning during the TVI, then the comments must indicate the cleaning was completed, and a new rating must be entered at 0.1 foot after the location where the TVI resumed after cleaning.

Example Photo	Code	Modifier / Severity	Description
	RP	1	<p>Root accumulation blocks up to 10% of pipe cross section</p>

	RP	2	Root accumulation blocks 10% to 20% of pipe cross section
	RP	3	Root accumulation blocks 20% to 30% of pipe cross section



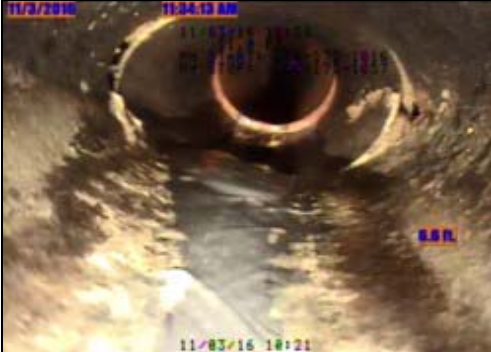
Example Photo	Code	Modifier / Severity	Description
	RP	4	Root accumulation blocks 30% to 40% of pipe cross section
	RP	5	Root accumulation blocks 40% to 50% of pipe cross section
	RP	6	Root accumulation blocks 50% to 60% of pipe cross section

Example Photo	Code	Modifier / Severity	Description
	RP	7	Root accumulation blocks 60% to 70% of pipe cross section
	RP	8	Root accumulation blocks 70% to 80% of pipe cross section
	RP	9	Root accumulation blocks 80% to 90% of pipe cross section

204.10 OUT OF ROUND

Use the out of round code (OV) primarily for flexible pipes (e.g. PVC, PEP) with an altered original cross section.

In some cases, rigid pipe may become deformed, although other defects such as severe cracking and collapse would also likely be present. Do not code these pipes as out of round unless the ovality is more pronounced than the normal pipe shape.

Example Photo	Code	Modifier / Severity	Item Description
	OV	L	<p><u>Out of Round, Light</u></p> <p>Slight flattening</p>
	OV	M	<p><u>Out of Round, Medium</u></p> <p>Obvious flattening</p>
	OV	S	<p><u>Out of Round, Severe</u></p> <p>Cannot pass camera at standard height</p>

205 CONTINUOUS DEFECT CODES




Use these codes to document observations that span a distance greater than 1 foot.

205.1 SOLIDS OR SEDIMENT

Use the solids or sediment code (SP) for accumulated material observed in the pipe. Material may include sand, gravel, silt, aggregate, or other matter. Large foreign objects not normally encountered in a pipe must be coded as Other (X) and noted in comments.

Code sediment or solids extending for more than 1 foot along the pipe with an end label (E) or new severity level at the location where the solids deposition ends or changes in severity. If severe sediment or solids are encountered that requires cleaning during the

TVI, then the comments must indicate that the cleaning was completed, and a new sediment rating must be entered at 0.1 foot after the location where the TVI was resumed after cleaning.

Example Photo	Code	Modifier / Severity	Item Description
	SP	L	<u>Solids or Sediment, Light</u> Thin layer of solids at flow line or on pipe walls
	SP	M	<u>Solids or Sediment, Medium</u> Medium layer of solids that may distort flow
	SP	S	<u>Solids or Sediment, Severe</u> Thick layer of solids that alters flow or could result in stoppage
	SP	E	<u>End of Solids or Sediment</u> No visible solids or sediment

205.2 CRACKED PIPE



Use the cracked pipe code (CP) for cracks that are visible on the inside surface of the pipe, but the pipe material is still intact.


A longitudinal crack is one that runs along the length of the pipe, or a long spiral crack (one that extends more than 1 foot in length).

A radial crack is one that runs around the circumference of the pipe, or a short spiral crack (one that extends less than 1 foot in length).

Multiple cracks are a combination of radial and spiral cracks or multiple occurrences of the same type of crack too numerous to enter as individual defects.

Longitudinal cracks and spiral cracks longer than 1 foot must be coded with an end label (E) or new severity level at the location where the crack ends or changes in severity. Indicate type of crack (longitudinal, radial, or spiral).

Example Photo	Code	Modifier / Severity	Item Description
	CP	L	<u>Cracked Pipe, Light</u> Hairline longitudinal, radial, or spiral crack
	CP	M	<u>Cracked Pipe, Medium</u> Moderate longitudinal, radial, or spiral crack, or multiple hairline cracks

	CP	S	<p><u>Cracked Pipe, Severe</u></p> <p>Large or open longitudinal, radial, or spiral crack, or multiple moderate or large cracks</p>
	CP	E	<p><u>End of Cracked Pipe</u></p>

206 LATERAL FEATURES AND DEFECTS OBSERVED FROM MAIN LINE INSPECTION

206.1 ROOTS IN LOWER LATERALS TAP

Use the roots in lower laterals code (RP_TP) for roots observed inside of a lower lateral during a main line TVI. If the roots from a lower lateral intrude into the main line, as observed during main line TVI, then also enter the RP code.

Code	Modifier/ Severity	Item	Description
RP_TP	1	No. 1 roots in lower lateral	Root accumulation blocks up to 10% of lower lateral cross section
RP_TP	2	No. 2 roots in lower lateral	Root accumulation blocks 10% to 20% of lower lateral
RP_TP	3	No. 3 roots in lower lateral	Root accumulation blocks 20% to 30% of lower lateral
RP_TP	4	No. 4 roots in lower lateral	Root accumulation blocks 30% to 40% of lower lateral
RP_TP	5	No. 5 roots in lower lateral	Root accumulation blocks 40% to 50% of lower lateral
RP_TP	6	No. 6 roots in lower lateral	Root accumulation blocks 50% to 60% of lower lateral
RP_TP	7	No. 7 roots in lower lateral	Root accumulation blocks 60% to 70% of lower lateral
RP_TP	8	No. 8 roots in lower lateral	Root accumulation blocks 70% to 80% of lower lateral
RP_TP	9	No. 9 roots in lower lateral	Root accumulation blocks over 80% of lower lateral cross section

206.2 GREASE IN LOWER LATERAL TAP

Use the grease in lower lateral (GP_TP) code for grease observed inside of a lower lateral during main line TVI.

Code	Modifier/ Severity	Item	Description
GP_TP	L	Grease, light	Thin layer of grease at flow line or on pipe walls
GP_TP	M	Grease, medium	Medium layer of grease that may distort flow
GP_TP	S	Grease, severe	Thick layer of grease that alters flow or could result in stoppage

206.3 OFFSET JOINT IN LOWER LATERAL TAP

Use the offset joint code (OJ_TP) for offset joints observed inside of a lower lateral during a main line TVI.

Code	Modifier/ Severity	Item	Description
OJ_TP	L	Offset Joint in lower lateral, light	Joint misaligned by $>1/4$ and $< 1/2$ wall thickness
OJ_TP	M	Offset Joint in lower lateral, medium	Joint misaligned by $1/2$ to wall thickness
OJ_TP	S	Offset Joint in lower lateral, severe	Joint misaligned by $<$ wall thickness or open, dropped, or separated

206.4 INFILTRATION IN LOWER LATERAL TAP

Use the infiltration code (IP_TP) for infiltration observed within the lower lateral during a main line TVI or infiltration observed coming into the main line from the lower lateral during a main line TVI. During TVI of the lower lateral, if the infiltration is occurring at a defect in the lower lateral (e.g. crack, offset joint).

Code	Modifier/ Severity	Item	Description
IP_TP	L	Infiltration in lower lateral, light	Dampness or water seeping
IP_TP	M	Infiltration in lower lateral, medium	Water dripping
IP_TP	S	Infiltration in lower lateral, severe	Water running or gushing

207 MISCELLANEOUS CODES

207.1 CHANGE IN PIPE MATERIAL

Use the change in pipe material observation code (MULTI_CM) when there is a change in pipe. Enter the appropriate material from the abbreviation list as a modifier to the code.

207.2 CHANGE IN PIPE LINING MATERIAL

Use the change in pipe lining material (MULTI_CLM) observation code when there is a change in pipe lining material. Enter the appropriate material from the abbreviation list as a modifier to the code.

207.3 CHANGE IN PIPE DIAMETER

Use the change in pipe diameter (MULTI_CD) observation code when the starting diameter is different from the recorded diameter for a pipe.

207.4 CHANGE IN PIPE LINER DIAMETER

Use the change in pipe liner observation code (MULTI_CLD) when there is a change in diameter along the pipe. Enter the appropriate diameter in the comment field.

207.5 ATTRIBUTE DATA ERROR

Use the attribute data error (ATT_DE) observation code to flag an asset attribute when the value is not the same as observed in the field. There are no modifiers for this code. Describe the item clearly in the comment field.

207.6 UNKNOWN ASSET

Use the unknown asset (UNK) observation when an unknown node is identified in the process of inspecting a main line.