Amendment to OPSS 409 (Nov 2009) – Construction Specification for Closed-Circuit Television Inspection of Pipelines

OPSS 409.05 MATERIALS

OPSS 409.05.01.01 Video Cassette Tapes and Tape Cases

Clause 409.05.01.01 of OPSS 409 is amended by deleting the first sentence in its entirety and replacing it with the following:

Video cassette tapes shall be a minimum high grade, new unused, and Super VHS format.

OPSS 409.07 CONSTRUCTION

OPSS 409.07.04.01 General

Clause 409.07.04.01 of OPSS 409 is amended by deleting the third paragraph in its entirety and replacing it with the following:

A fixed camera shall be used for pipelines less than 200 mm in diameter. For pipelines equal to or greater than 200 mm, a pan and tilt camera shall be used. Each camera must have an accepted sample submissions report prior to being used for inspection work. The camera lens shall be kept clean at all times during the inspection.

OPSS 409.07.05.01 Survey Reporting

Clause 409.07.05.01 of OPSS 409 is deleted in its entirety and replaced with the following:

Survey reports shall be submitted to the Contract Administrator in the following formats, within 10 Working Days of the completion of the field work, with the noted number of copies.

a) One bound copy of the printed report in book format with cerlox binding which includes the following:

- A copy of each community map to reference work locations.
- A sleeve bound behind the last page to adequately hold each map.
- Photographs of pipe defects as requested.
- A hard cover with the following information:
  1. Book and video numbers.
  2. The community area (only one per book).

3. Inspection dates.
4. Sewer section numbers (e.g. 6439 to 6514)
5. Total metres inspected in that book.

b) Two – 3.5 inch computer disks, CDs, or DVDs as specified in the Contract Documents each containing the identical survey report information as in the printed copies.

c) One copy of the video recording.

d) Two CD-ROM renderings/copies shall be provided by the Contractor.

Each CD-ROM shall be capable of having up to 2 hours of Full Frame Colour Video encoded onto it in one continuous MPEG file, that is one CD-ROM per video.

The CCTV data must also be CD-ROM compliant in that the video digits in the data accurately reflect the position on the CD-ROM.

The CCTV video recording (CD version) must be indexed to the textual data. The field survey must record the time index on the video which shows the images corresponding to the text record. The indexing must include the start time of the entire survey and the exact time number for each pipe feature/defect recorded in the data.

This indexing will permit the user to view a particular sewer pipe or a particular feature/defect in a pipe, after inserting the appropriate CD, and then advance to the stored time index in the MPEG file, then display the image(s).

All required header information fields shall be completed and verified for correctness. The software used to produce the survey report shall not allow the operator to continue inputting information until the preceding field has been completed. The report shall be machine printed and presented according to the MSCC.

All dimensions in the survey report shall be metric.

CONSTRUCTION SPECIFICATION FOR CLOSED-CIRCUIT TELEVISION INSPECTION OF PIPELINES

TABLE OF CONTENTS

409.01 SCOPE

This specification covers the requirements for inspecting new and existing sanitary and storm pipe sewers and pipe culverts by closed-circuit television and the work of cement mortar lining of watermains.

409.01.01 Specification Significance and Use

This specification has been developed for use in provincial- and municipal-oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities and the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.

409.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

409.02 REFERENCES

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

Water Research Centre (WRc) Publication

MSCC Manual of Sewer Condition Classification, Third Edition, 1993

409.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Business Day means any day except Saturdays, Sundays, and statutory holidays.

CCTV means closed-circuit television.

CD means compact disc.

Drainage Structure means a catch basin, maintenance hole, or ditch inlet.

DVD means digital videodisc.

MPEG means movie photographic experts group.

NAAPI means North American Association of Pipeline Inspectors.

VCR means video cassette recorder.

409.04 SUBMISSION AND DESIGN REQUIREMENTS

409.04.01 Submission Requirements

The following information shall be submitted to the Contract Administrator two weeks prior to the start of the CCTV inspection operations:

a) A copy of the CCTV operator's NAAPI Certification Certificate. A copy of said certificate is required for each CCTV operator working on the Contract. Operators shall have been certified or re-certified within the five years prior to the start of the Contract.

b) A sample inspection report, resolution tests of videotape and digital MPEG video recordings, and digital data file. One submission is required for each camera proposed for use on the work. The camera make, model, and serial number shall be clearly identified on each video recording.

c) The details of the coding accuracy verification system that is to be used to verify inspection accuracy.

409.05 MATERIALS

409.05.01 General

Media storage shall be as specified in the Contract Documents.

Video cassette tape, CD, and DVD cases shall have permanent labels that are capable of displaying the following information or as specified in the Contract Documents:

a) Owner’s Name

b) Contract Number or Project Name

c) Sewer Identification Number

d) City or Town

e) Street Name

f) Inspection Date

409.05.01.01 Video Cassette Tapes and Tape Cases

Video cassette tapes shall be a minimum high grade, new unused, and VHS format.

Video cassette tape cases shall be hard plastic with wrap around clear plastic windows capable of displaying the tape content on the label.

409.05.01.02 Compact Discs and Disc Cases

CDs used to submit digital format video recordings transferred from a computer hard drive shall be compact disc media recordable (CD-R).

CD cases shall be 5.2 mm slim-line clear jewel cases capable of displaying the tape content on the label.

409.05.01.03 Digital Videodiscs and Disc Cases

DVDs used to submit digital format video recordings transferred from a computer hard drive shall be digital videodisc media recordable (DVD±R).

DVD cases shall be 5.2 mm slim-line clear jewel cases capable of displaying the tape content on the label.

409.05.01.04 Photographs

Photographs are to be in colour with a minimum image size of 90 x 70 mm and shall be reproduced on premium glossy photo quality paper or digital image in MPEG as specified in the Contract Documents.

409.06 EQUIPMENT

409.06.01 General

Survey and camera equipment used to inspect the work of cement mortar lining of watermains shall have been used exclusively for work in watermains.

409.06.02 Survey Vehicle

The survey vehicle shall contain a separate area for viewing, recording, and controlling the CCTV operation.

The viewing and control area shall be insulated against noise and extremes in temperature. External and internal sources of light shall be controlled in a manner as to ensure the light does not impede the view of the monitor screen. Proper seating accommodation shall be provided to enable persons, in addition to the operator, to clearly view the monitor screen.

All equipment used within the pipeline shall be stored outside the viewing, recording, and control area.

The vehicle shall include a telephone or suitable alternative as agreed by the Contract Administrator for the duration of the work.

409.06.03 Survey Equipment

The surveying equipment shall be capable of surveying a length of pipeline up to:

a) 350 m where entry to the pipeline may be obtained at each end of the pipeline;

b) 30 m where rodding is used; or

c) 150 m where a self-propelled unit is used when entry is at only one end of the pipeline.

Work shall not commence in a work shift until the Contract Administrator is satisfied that all items of the survey equipment have been provided and are in full working order.

Each survey unit shall contain a means of transporting the CCTV camera in a stable condition through the pipeline.

Where the CCTV camera is towed by winch and cable through the pipeline, all winches shall be stable during the entire CCTV inspection. All cables shall be of steel or of an equally non-elastic material to ensure the smooth and steady progress of the CCTV camera.

Each unit shall carry sufficient number of guides and rollers such that, when surveying, all cables are supported away from pipe and maintenance hole edges. All CCTV cables and lines used to measure the camera's location within the pipeline shall be maintained in a taut manner and set at right angles, where possible, to run through or over the measuring equipment.

409.06.04 Video Equipment Quality

The electronic systems, television camera, and monitor shall be of such quality as to enable the following to be achieved.

409.06.04.01 Camera

The pan and tilt camera shall have the capability of panning the pipe at 360° with tilt capability of 275° to ensure complete inspections and view of all laterals and deficiencies.

Resolution

The live picture shall be visible with no interference and capable of registering a minimum number of lines of resolution at the periphery as indicated below:

a) Fixed view camera 350 lines of resolution.

b) Pan and tilt camera 400 lines of resolution.

Colour Constancy

To ensure the camera provides optimum results when used with its own illumination source, the lighting shall be fixed to intensity prior to commencing the survey. To ensure colour constancy, no variation in illumination shall take place during the survey.

Focus, Iris, and Illumination

The adjustment of focus and iris shall allow optimum picture quality to be achieved and shall be remotely operated. The illumination shall be such as to allow an even distribution of the light around the pipeline perimeter without the loss of contrast or flare out of picture shadowing.

409.06.04.02 Analog Video Recorder

Analog video recorders shall be a VCR capable of reproducing a resolution at the periphery of a minimum of 250 lines recorded at standard VHS speed. The VCR shall have four heads and shall be capable of capturing recordings in colour.

409.06.04.03 Digital Video Recorder

Digital video recorders shall be able to capture in colour from the live video source in parallel with the VHS tape recording to the following requirements:

a) HQ-VCD MPEG1 requirements.

b) Picture Size: NTSC 352 x 240 @ 29.97 frames per second.

c) Data/Bit Rate: MPEG-1 @ 2.4 M-bits/sec.

409.07 CONSTRUCTION

409.07.01 Pipeline Cleaning

When specified in the Contract Documents, pipelines shall be cleaned and flushed immediately prior to CCTV inspection.

409.07.02 Resolution of Videotape and Digital MPEG Video Recordings

Prior to the start of the CCTV inspection, the resolution of VHS and digital MPEG video playback for each camera shall be confirmed by recording a resolution chart approved by the Contract Administrator, using the following procedure:

a) Set up the camera as is done for the actual inspection.

b) Show the camera being introduced and reaching its final position for the test.

c) Fill the monitoring screen with the resolution chart.

d) Illuminate the resolution chart evenly and uniformly without reflections ensuring that the illumination source accurately simulates the lighting used in the sewer.

e) Record a test video for 30 seconds.

f) Identify the camera make, model, and serial number on the recording.

g) Record the test at the start of a video cassette tape or digital recording.

The resolution test shall be submitted to the Contract Administrator.

409.07.03 Coding Accuracy

Prior to commencement of the CCTV inspection, a formal coding accuracy verification system, based on accuracy as a function of the number of defects or construction features not recorded and the correctness of the coding and classification recorded, shall be developed, submitted to the Contract Administrator, and implemented when approved.

Verification of coding accuracy shall be done on a random basis on a minimum of 10% of the inspection reports or one per videotape, whichever is greater. A minimum of two accuracy verifications must be done for each operator for each week working.

Inspections not satisfying the accuracy requirements shall be re-coded to meet the accuracy requirements and the accuracy of the inspections immediately preceding and following the non-compliant inspection shall be verified. This process shall be repeated unit the preceding and subsequent inspections meet the accuracy requirements.

Coding accuracy checks shall be submitted to the Contract Administrator along with the corresponding video recording.

409.07.04 CCTV Inspection

409.07.04.01 General

The work shall include a CCTV inspection of the pipeline and the preparation of all video, digital, and written reports.

A NAAPI certified CCTV operator shall be used to operate the inspection equipment and code the inspection.

A fixed camera may be used for pipelines less than 300 mm in diameter. For pipelines equal to or greater than 300 mm, a pan and tilt camera shall be used. Each camera must have an accepted sample submissions report prior to being used for inspection work. The camera lens shall be kept clean at all times during the inspection.

Flow control measures as specified in the Contract Documents shall be implemented to ensure a minimum of 80% of the height of the pipeline is visible for the entire inspection and shall be approved by the Contract Administrator.

All fog shall be evacuated from the pipeline and the pipeline kept clear of fog during the inspection.

At the start of each pipeline being surveyed, the length of pipeline from zero chainage up to the cable calibration point shall be recorded and reported in order to obtain a full record of the:

a) pipe sewer length from the inside face of the maintenance hole to the inside face of the next maintenance hole or outlet end of the pipe sewer;

b) pipe culvert length from one end of the pipe culvert to the other; or

c) watermain length from the valve pit entry point to the valve pit exit point or termination of the cement mortar lining.

The metre reading entered on to the data display at the cable calibration point shall allow for the distance from the start of the survey to the cable calibration point such that the metre reading at the start of the survey is zero.

In the case of surveying through a maintenance hole where a new header sheet is required, the metre reading shall be set at zero with the camera focused on the outgoing pipe entrance.

At the start of each maintenance hole length, a data generator shall electronically generate and clearly display on the viewing monitor and video recording a record of data in alphanumeric form containing the following minimum information:

a) Automatic update of the camera’s metre reading position in the pipeline from adjusted zero.

b) Pipeline dimensions.

c) Maintenance hole and pipe length reference numbers.

d) Date of survey.

e) Road name and location.

f) Direction of survey.

g) Time of start of survey.

h) Pipeline use.

Once the survey of the maintenance hole length is underway, an automatic update of the camera's metre reading position in the pipeline from zero in metres and tenths of a metre shall be continually displayed.

The camera shall be stopped when defects are being noted on the coding sheet.

Defects in each pipeline length shall be coded according to the MSCC. Any variation from the manual shall be noted in the survey report.

The survey shall be restarted at the opposite end of the pipeline if a blockage or obstruction is encountered.

Inspections shall be recorded in colour.

Digital video recordings may be saved to a computer hard drive and transferred to a compact disc or digital video for submission.

An analog format video recording of an inspection shall be recorded at standard play speed, SP mode, on a video cassette tape using an analog digital video recorder.

A digital format video recording of an inspection shall be produced in colour from a first generation recording by one of the following methods:

a) A computer system and a video capture card shall be used to capture the recording continuously regardless of the progression of the inspection. Before submission, the raw digital data shall be edited to remove pauses where the inspection progress was not continuous.

b) A computer system and a video capture card shall be used to intermittently capture the recording. Before submission, the raw digital file shall be edited to form one continuous file.

c) Specialized video recording equipment capable of pausing and resuming live recording shall be used to capture original recording. A single file is to be produced for submission.

Video capture equipment shall be capable of capturing digital video from first generation recordings with no frame loss.

Non-linear video editing software shall be used to edit digital videos. Edited digital files shall not be recompressed.

409.07.04.02 Camera Position

The camera lens shall be positioned centrally in a circular pipeline and at two-thirds of the vertical dimension in a non-circular pipeline with a positioning tolerance of ±10% of the vertical pipeline dimension.

In all instances the camera lens shall be positioned looking along the longitudinal axis of the pipeline.

409.07.04.03 Camera Travel Speed

The travelling speed of the camera in the pipeline shall be limited to:

a) 0.1 m/s for pipeline of diameter less than 200 mm;

b) 0.15 m/s for diameters exceeding 200 mm but not exceeding 310 mm; and

c) 0.20 m/s for diameters exceeding 310 mm.

409.07.04.04 Camera Position Metre-Reading Device

A suitable metre-reading device shall be used that enables the cable length to be accurately measured to indicate the location of the camera. The metre-reading device shall be accurate to ±1% of the length of the sewer being surveyed. The tolerance shall be demonstrated using one or both of the following methods in conjunction with a linear measurement audit form that shall be completed each day during the survey:

a) Cable calibration device.

b) Tape measurement of the surface distance between maintenance holes.

If the accuracy of the measuring device fails, it is to be replaced. The Contract Administrator may require that the lengths of pipeline first inspected with the original measuring device be resurveyed using the new measuring device.

409.07.05 Final Documentation

409.07.05.01 Survey Reporting

Survey reports shall be submitted to the Contract Administrator in the following formats, with the noted number of copies, within 10 Business Days of the completion of the fieldwork:

a) 3 copies of the printed survey report.

b) 2 - 3.5 inch computer discs, CDs, or DVDs as specified in the Contract Documents each containing the identical survey report information as in the printed copies.

c) 2 copies of the analog or digital video recording.

Entire inspections shall be contained on one video cassette tape or within one digital file on a single CD or DVD, as applicable. Where possible, reverse set-up inspections shall be recorded immediately after the original inspection.

Each digital file shall contain the file name with a maximum of 64 characters according to the following:

a) Tender number

b) E<Entity number>

c) F<From entity number>

d) T<To entity number>

e) Street Name

f) M<Measured length>

g) I<Inspected length>

h) <inspection direction: DS or US>

i) <letter designating inspection sequence> .MPEG

For example: 910-200 E5329 F5328 T5350 BERRY M100.0 I39.2 US B.MPEG indicates that this is the second or “B” partial inspection of this entity, 39.2 m long.

All required header information fields shall be completed and verified for correctness. The software used to produce the survey report shall not allow the operator to continue inputting information until the preceding field has been completed. The report shall be machine printed and presented according to the MSCC.

All dimensions in the survey report shall be metric.

The survey report shall identify major defects and shall include photographs when the need for photographs are specified in the Contract Documents.

409.07.05.02 Drawings

One clean set of the Owner's drawings showing maintenance hole numbers that coincide with the coding sheets and video tapes shall be returned to the Contract Administrator on completion of the survey. The drawings shall be clearly annotated to show any discrepancies between the drawings and the survey report. Such discrepancies shall be brought to the attention of the Contract Administrator during the survey.

409.07.06 Management of Excess Material

Management of excess material shall be as specified in the Contract Documents.

409.08 QUALITY ASSURANCE

Upon submission, printed and digital inspection reports, video cassette tape and digital MPEG video recordings, magnetic data files, and coding accuracy checks shall be reviewed to ensure compliance with the Contract Documents.

Submittals shall be reviewed by the Contract Administrator and their acceptance confirmed within 10 Business Days of submission. Only inspections with minimum accuracy for header information of 95%, and minimum detail accuracy for defects and features of 85% will be accepted. Non-compliant submissions will be returned for correction. Corrected submissions must be returned to the Contract Administrator for review within 5 Business Days.

Operators failing to meet the coding accuracy requirements on two occasions shall not be permitted to code on the remainder of the Contract unless they successfully re-attain the NAAPI Level of Qualification for CCTV Operators.

409.09 MEASUREMENT FOR PAYMENT

409.09.01 Actual Measurement

Measurement for a CCTV inspection of pipeline shall be measured in metres on the ground surface along the centreline of the pipe sewer from the centre of one drainage structure to the centre of another drainage structure or outlet end of the pipe sewer. Measurement for pipe culverts shall be from one end of the pipe culvert to the other end of the pipe.

Measurement for a CCTV inspection of watermain shall be measured in metres on the ground surface along the centreline of the watermain from the valve pit entry point to the valve pit exit point or termination of the cement mortar lining.

In the event that a CCTV inspection is terminated due to a blockage or collapsed pipe or the pipe is inaccessible, measurement shall be in metres for the actual length of pipeline inspected as determined from the chainage indication on the videotape.

409.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clause under Actual Measurement.

409.10 BASIS OF PAYMENT

409.10.01 CCTV Inspection - Item

Payment at the Contract price for the above item shall be full compensation for all labour, Equipment, and Material to do the work.

When the Contract does not contain a separate tender item for CCTV inspection, the Contract price for the appropriate tender item for the installation of pipe sewers, pipe culverts, or the work of cement mortar lining of watermains shall include full compensation for all labour, Equipment, and Material to do the work of CCTV inspection.

Non-compliant submissions returned for correction shall be corrected and resubmitted at no expense to the Owner.

Appendix 409-A, November 2009
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer should specify the following in the Contract Documents:

- The type of media storage. (409.05.01)

- Additional or different labelling information for cases. (409.05.01)

- Flow control measures. (409.07.04.01)

- Disc type for survey report information. (409.07.05.01)

Flow control measures may include such things as scheduling work for off-peak flow times, plug or block flow at upstream manhole, and temporary by-pass pump flow around inspection section. (409.07.04.01)

The designer should determine if the following is required and if so, specify it in the Contract Documents:

- If payment for CCTV inspection is to be included in the Contract price for installing storm or sanitary pipe sewers, or pipe culverts, or if payment will be a separate CCTV item or items. (409.10.01)

- If photographs are required as part of the CCTV inspection. (409.07.05)

- Photograph reproduction on paper or in MPEG. (409.05.01.04)

- If the Contractor is to clean and flush pipelines prior to commencement of CCTV inspection. (409.07.01)

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

No information provided here.