FIELD CODING PROCEDURES

The City of Greater Sudbury Construction Surveyors' create CAD drawings using AutoCAD Civil3D, CGS Master Field Code Library, Code Sets and the CGS Template. Knowing how each part plays a role in developing the finished product that meets our standards is imperative.

Codes are a combination of letters/symbols, from the CGS Master Field Code Library and Linework Code Sets used to describe objects tied-in during a survey. **All codes and linework code sets are case sensitive and must be in Block Capitals. See 10-4 CODING EXAMPLE DIAGRAMS in the manual to refer to while reading the following coding procedures.**

Coding for a single shot: Codes that are used for single shots and not used to draw a line, have a ~!~ after each code. The Tilde (~) represents a space and the exclamation point (!) is a 'Code Set' that tells Civil3D **not** to draw a line. An example is TREE~!~ or GRVL~!~.

Coding for single shots with added text: A description can be added to the end of any code to describe something about the shot, for example: SIB~!~ BENT SOUTH or VB~!~ 4-56 or BLG~ 2355 BARRYDOWNE. When tying in a building, the building number and street name are only put on the **first shot** and the remaining shots would be coded as BLG~. Be sure to leave a space after the last Tilde (~) before typing in a description.

When coding to draw a line in CAD, you must always take the next shot on the line ahead of the previous shot taken on that same line. A good analogy for this is like 'connect the dots'.

Coding for drawing a line: An example for a line would be EP~ which is used to draw a line along edge of pavement. When you want the line to end, add the Linework Code Set, an exclamation point, to the code of the last shot, for example: 'EP~!~. A Tilde is always used before and after the exclamation point so there is no interference with any other line used for EP.

Coding for connecting the last shot to the first shot in a line: An example for this would be when tying in a flower bed of any shape, except a circle. The coding would be BED~ on the first shot and all subsequent shots along the edge of the flower bed. On the last shot use the Linework Code Set + to join the last shot back to the first shot on the line in order to close the shape, for example, BED~+~.

Coding for circular objects: An example for this would be when tying in a round flower bed. The coding would be BED~BC~ on the first shot only where BC~ tells CAD to begin the curve on the flower bed line. The remaining shots on the circle would be coded as BED~. The last shot on

the circle would be a few centimeters away from the first shot and coded as BED~!~EC~, ! tells CAD to end the line and EC tells CAD to end the curve at that shot.

Coding to close a square or rectangle: An example of this would be when tying in a building. The first shot on the building would be coded as BLG~ 2355 BARRYDOWNE, leave a space after the Tilde then enter the building number and the street name. The second code would be BLG~ and the third code would be BLG~RT~5.125~+~ if the direction from the third shot to the next corner is to the right. If the direction from the third shot to the next corner is to the left, then the code would have a negative number, for example, BLG~RT~-5.125~+~.

Coding for points on a curve: An example of this would be for the curve along edge of pavement, curb, boulevard and sidewalk as it transitions from one street to another. Where the edge of pavement meets the curb, only shoot the edge of pavement to draw one line, coded EP~, do not shoot the curb at this point. Where the top of curb meets the boulevard, only shoot the top of curb to draw one line, coded CURB~, do not shoot the edge of boulevard at this point. Where the boulevard meets the sidewalk, only shoot the boulevard to draw one line, coded BLVD~, do not shoot the sidewalk at this point or there would be too many lines to close together on the drawing. Shoot the back of the sidewalk to draw one line for the sidewalk, coded SW~. The shot where the curve starts would be coded as EP~BC~ and CURB~BC~ and BLVD~BC~ and SW~BC~, this starts the arc in the curve on each line. Each shot along each curved line would then be coded as EP~ and CURB~ and BLVD~ and SW~. In order to draw a smooth curved line, shots along the curve should be relatively close, (2 m), and the shots on EP, CURB, BLVD and SW **should be at the same intervals along the curve**. The last shot on the end of the curve would be coded as EP~EC~ and CURB~EC~ and BLVD~EC~ and SW~EC~ which ends the arc on the curved lines. When these lines end they would be coded as EP~!~ and CURB~!~ and BLVD~!~ and SW~!~.

Coding for shooting multiple lines : Always start at one end of the job and work towards the other end. The structure that you are tying-in is the predominant figure and will be the first code in the string of codes.

Starting on a storm manhole and moving to a manhole catchbasin would be coded, STMH~ 8-1, after the Tilde leave a space and add the predominant figure number (structure number).

On the next structure (MHCB), code as MHCB~STMH~!~ 8-2, this ends the line from the storm manhole and starts a new line from the MHCB to the storm manhole and leave a space after the Tilde and add the predominant figure number (structure number).

The next structure is a MHCB, from that point draw three lines to three other structures that join to this point. Code as MHCB~!~STMH~STMH1~CB~ 8-3. This ends the MHCB line and starts

three other separate lines. Since there are two storm manholes in different directions from this point, use STMH~STMH1~. Leave a space after the Tilde and add the predominant figure number (structure number).

Move to the CB next and code as CB~!~ A. This ends the CB line and after the Tilde leave a space and add the structure number or in the case of catchbasins that are not numbered, designate a letter to the structure that will correspond to the structure invert elevation field notes.

Next move to STMH 8-4 and code as STMH1~!~ 8-4. This ends that line and describes the number of the predominant figure.

Next move to STMH 8-5 and code as STMH~!~DCB~ 8-5. This ends the STMH line and starts a new line from this point to the double catchbasin. Leave a space after the Tilde and add predominant figure number.

Next move to the double catchbasin and code as DCB~!~ B. This ends the line at the DCB and after the Tilde leave a space and add the predominant figure number.

HOW TO TIE-IN DETAIL IN THE FIELD

Tie-in all roadwork, hydro poles and municipal signs together in the first sweep. All other detail, except for structures, is tied in after the road work is complete. Structure inverts are done before horizontal tie-ins to ensure lines are drawn to join each structure correctly in the system. Lines are drawn for all road work including centre line. Start at either the South end or the West end of the job and tie-in points where the line changes direction and at each 15m station. Shots are taken on centerline CL~, edge of pavement EP~, top of curb at back CURB~, edge of asphalt boulevard where it meets the sidewalk BLVD~ and back of sidewalk SW~. Move ahead 15m and work your way backwards on the same profile, SW~, BLVD~, CURB~, EP~ and CL~. Continue this until each line is ended. On curved lines such as curb returns, shots are taken closer together and at the same intervals for each profile line so the lines in the drawing appear smooth.

When shooting the center of objects, they require either a two (2) point distance offset or a distance/angle offset to reflect the center of the object accurately. Below are brief descriptions on how to tie-in these objects. All measurement descriptions are to be in millimeters.

MUNICIPAL SERVICES

- Center of Manholes – Sanitary and Storm
- Center of Catchbasins
- Center of Ditch Inlet Catchbasins and Birdcage Catchbasins with an additional shot on the frame where the water flows into the structure for elevation. This elevation is edited into the shot for the center of the structure and then the shot on the frame is deleted.
- Center of Valve Chambers, Swab Launch Stations and Valve Boxes
- Center at back of Hydrants and center of Hydrant Valve Boxes
- Center of Service Boxes
- Center of Water Wells (non municipal) and water monitoring wells

STORM SEWER DETAIL

- When approaching a culvert, end the ditch line just before the culvert, DIT~!~, then tie-in the invert of the culvert, CULV~ 450 CSP INV, then tie-in the other end of the culvert and end the line, CULV~!~ 450 CSP INV. Start a new line to continue the ditch, DIT~.
- Shoot the top of the culverts at each end and add the pipe diameter to the rover pole height in order to keep the rover level and the horizontal position more accurate. Use an even 2m for a rover pole height so it is easy to add the diameter to it and reduces risk of error. If culverts are buried deep then the top of the culvert can be shot and coded as CULV~ 450 CONC TOP. In these cases it is often hard to determine size and type of pipe.
- All culverts tied-in at the invert of the pipe, include size, pipe type and invert or top.
- Box Culverts are tied-in by taking one shot on top of each of the four (4) corners and coded as CULV~ TOP. Also take one shot at each end in the center at the invert, include size, type and inv, for example, CULV~ 1200 X 1500 CONC INV.
- Sub-drains tied-in at the invert of the pipe, include size, type, inv or top
- Outline the top of Storm Headwalls, bottom of ditch will reflect the elevation at bottom of the headwall.
- Centerline of Swales and outline Spillways and also profile their center line.

UTILITIES

- Center of Bell Poles and Hydro Poles (Please note what is on the pole after leaving a space after the Tilde, for example, HPOLE~!~ TTVLS 3TRANS, T for Telephone, TV for Cable, LS for Lamp Standard and 3TRANS for three (3) Transformers)

- Center of Anchor Poles
- Guy Wires where they anchor to the ground (join guys wires with the pole if more than one pole in the immediate area)
- Center of all Manholes – Gas, Hydro, Bell and Fiberoptics, etc.
- Center of Electrical Handholes and Junction Boxes
- Center of all Pedestals
- Center of Gas Regulators
- Center of Gas Valves
- Center of all Lamp Standards
- Hydro Transformers – Outline concrete pad, '232.CONC', take one shot on center of Transformer using an offset shot.

TRAFFIC CONTROL

- Center of Traffic Junction Boxes and Traffic Handholes
- Center of Bollards
- Center of Signs – if sign has two posts, shoot both and draw a line between the two
- Center of Traffic Light Standards and Walk Light Standards
- Center of Traffic Controller – outline the concrete pad and one shot on center of controller box
- Railway Tracks -- shoot top of both rails, for example, RWY~ and RWY1~
- Railway Junction Box - outline concrete pad if it sits on one then use a two point offset shot to tie-in center of box
- Center of Railway Signal Pole and Wigwag Arm Base

VEGETATION

- Center of a Tree - for a line of trees that are the same or of similar type and are spaced out evenly, draw a line between the first and last tree, no need to tie-in every tree.
- Centerline of a Hedge drawing a line
- Center of a Shrub/Bush
- Center of a Stump
- Edge of Flower Beds – take a few shots inside the bed **without** a Line Joiner for elevation.
- Edge of a Planter Box
- Edge of a Bushline

DETAIL WITHIN RIGHT-OF-WAY AND PRIVATE PROPERTY

Most Codes for road detail in the Field Code Library are used as Line Joiners to draw lines in the CAD drawing.

- Edge of Pavement, Shoulders, Curbs, Boulevards, Sidewalks, Trails, Driveways and Parking Lots.
- Top and Bottom of Slopes/Break Lines using a Line Joiner.
- Portable Curb shot on top at center, begin and end each individual curb, for example, CURB~ for the first shot and CURB~!~ for the second/last shot.
- Cable Guide Rails start and end where the anchor cable goes into the ground and shoot both the first and last wood post, other shots are taken at 15m stations intervals.
- Steel Beam Guide Rails start and end where the end of the metal beam is and shoot both the first and last metal post, other shots are taken at 15m station intervals.
- Rock Outcrops are outlined using Earth to Rock Code, ERK~ all the way around top, bottom and sides. A line is drawn for the rock face from one end to the other using RK~ and individual cross sections/profiles are shot at 7.5m station intervals and at any break lines. **Follow Health and Safety Procedures for Working at Heights (travel restraint).**
- Edge of driveways – use the Code that specifies the construction material.
- Edges of retaining walls using the code that specifies the construction material. For retaining walls under 100 mm in width, the center line of the wall can be tied-in when stating the width of the wall and that center line was tied-in, for example, WRET~ 100 CL.

  All retaining walls 150 mm and up, outline the top of the entire wall.
- Edge of sidewalks on Municipal property and walkways on private property.
- Edge of parking lots

BUILDINGS

All buildings are tied-in with a Total Station with a minimum of three (3) shots per building or tie-in every jog around the entire building. On the first shot provide a description of the municipal address, for example, BLG~ 2355 BARRYDOWNE.

Square or rectangular shaped buildings are shown as a closed shape on the CAD drawing. Depending on the direction from the third shot to the next corner of the building determines what coding sequence is used. If the direction is to the right then use BLG~RT~5.125~+~, 5.125 is the length of the wall on the opposite side of the

building. If the direction is to the left, use a negative sign in front of the distance, for example, BLG~RT~-5.125~+~

All other buildings must either be measured with a cloth tape and a sketch is to be provided on field note paper **or** a separate building drawing in CAD for only the buildings that are not closed on the main detail drawing.

If creating a separate drawing for buildings, it must be done in 2D. Copy the building shots to a new wordpad document in numerical order. Change the .txt to csv and open in excel. Change all elevations to zero then select Northing, Easting and Elevation columns and be sure they show 3 to 4 decimal places. Change the .csv file back to a .txt file and name the file with 2D in the name. Create a new drawing in the BUILDINGS folder and save as the name of the main drawing name but add BUILDINGS to the end of the name.

If drawing the buildings on field note paper, orient the drawing so North points up the page, if possible, and show the North arrow on each page with one building per page. Show the street/streets and street names on each page. Inside the outline of the building drawing, write the municipal address, for example, 2355 BARRYDOWNE. Show all building dimensions for each wall.

- Outline Buildings with a minimum of three (3) shots per building, add the building number and street name to the description of the first shot only, for example, BLG~ 2355 BARRYDOWNE
- Detached garages and carports are tied-in with a minimum of three (3) shots and closed on the main Cad drawing if they are square or rectangular. If they are not square, tie-in every corner of the building or measure it with a cloth tape and draw it on field note paper or create a buildings drawing.
- Attached garages and carports are tied-in with the main building. If shooting the main building first and then moving on to the garage, end the line for the main building and continue with a line for the garage, for example, BLG~!~GAR~. If not tying in around the entire building, submit a drawing on field note paper or create a buildings drawing.
- Outline Portable Carports and Sheds closing the line on the last shot as described above for square or rectangular buildings.
- Outline Bus Shelters and outline the concrete pad that it sits on as well.

MISCELLANEOUS

- Centerline of all Fences and change Code to gate when appropriate, for example, FEN~!~GATE~ for the first shot on the gate then to GATE~!~FEN~ for the other end of the gate then back to FEN~ to continue to the end of the fence then code FEN~!~.
- Edge of all Walkways using a line joiner
- Outline all Boxes: Garbage, Donation, Sandbox, and Mailboxes, except for private Mailboxes, where only one shot is required.
- Center of all Handrails using a Line Joiner
- Outline all Steps and Landings, on the landing, take the first shot at the building, LAND~, then out to the corner, LAND~, then on the landing where the stringer for the stairs is, LAND~STEP~, then to the top outside corner of the bottom step, STEP~, then across to the other side of the last step, STEP~, then to the top of the landing in line with the steps, STEP~!~LAND~, then to the next corner of the landing, LAND~ then to the landing at the building, LAND~!~.
- Outline Bleachers and Back Stops
- Center of Posts and Boreholes

WATERWAYS

Follow Fall Arrest Procedures when working close to watercourses.

- Edges and centerline of all waterways drawing a line
- Edge of Swamps drawing a line
- Outline Bridges and Bridge Abutments on both sides
- Outline Rip Rap – take a few shots on the Rip Rap without a Line Joiner for elevation.

AS-BUILT CODES

Use As-built Codes are generally used for detail that has just been installed during a construction project and would be coded as single shots, for example, SBEND~!~. When tying in structures, line work needs to be used to join them in the drawing.