CI225943

BC Ministry of Transportation Civil 3D Implementation

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Learning Objectives

- Appreciate the level of effort required to properly implement Civil 3D to a major transportation organization
- Understand the importance of technology implementation in terms of individual workflows
- Understand how data can be capitalized on and moved efficiently through all transportation infrastructure project procurement phases
- Discover the importance of having good tools for collaboration and sharing important project information

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Description

The BC Ministry of Transportation and Infrastructure (BC MoTI) plans transportation networks and provides transportation services and infrastructure for the Province of British Columbia. BC MoTI has transitioned from CAiCE and is now using Civil 3D software for consultant and in-house survey, design, and construction administration workflows. This class will detail the entire Civil 3D implementation process, including a BIM (Building Information Modeling)-based approach for the development of workflows and data handoffs, CAD standardization, subassembly and application customization, training and information dissemination, continued support, and documentation. The end product is a Civil 3D terms-of-reference document that describes all of the requirements for using Civil 3D for survey, design, and construction administration tasks, and is applicable to both Ministry staff and private sector consultants.
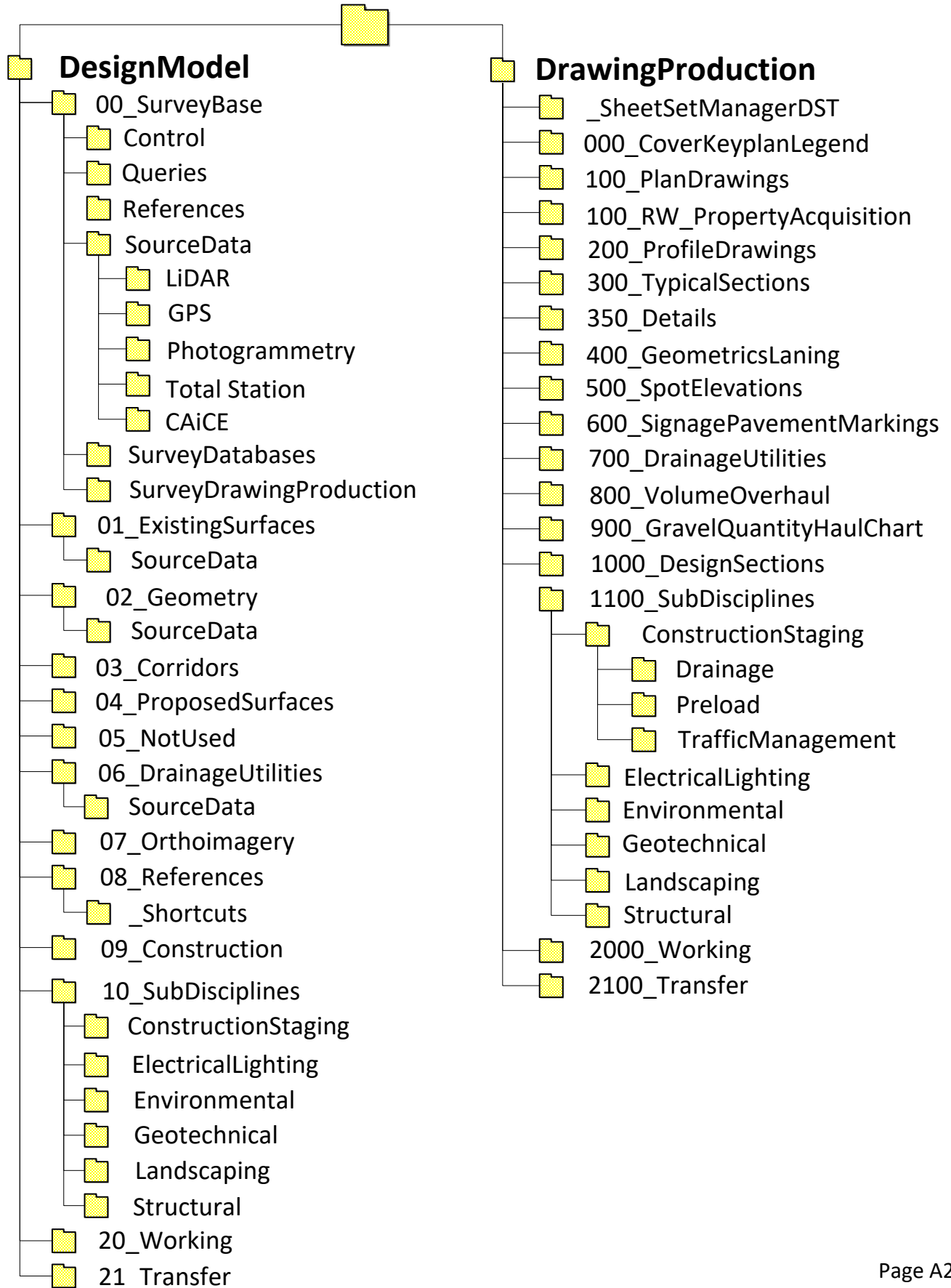
Speaker(s)

Andrew Walther, P.Eng., has been consulting in the infrastructure industry for 20 years and specializes in the implementing of Civil 3D to public and private sector organizations across North America. Notable clients include BC Ministry of Transportation, USDA Natural Resources Conservation Service, US Bureau of Reclamation and BC's Master Municipal Construction Documents Association.
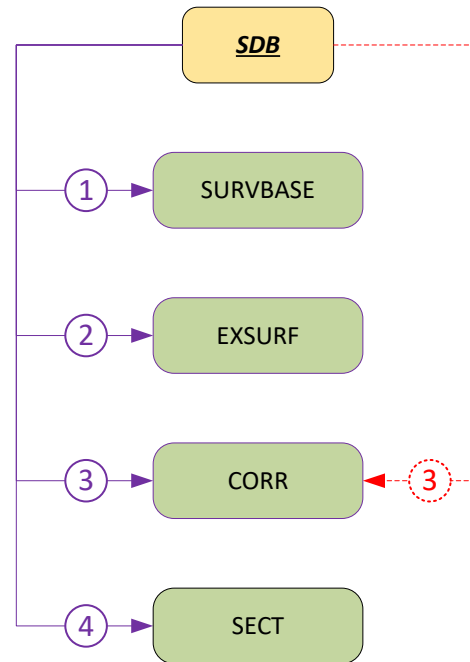
Key Factors

The most important factors to consider when implementing Civil 3D to a major transportation organization are as follows:

1. Understanding the current business and the people involved
2. Development is done in terms of workflows with specific inputs and outputs (deliverables)
3. Rigid standards for data structure, sharing mechanisms and naming conventions
4. Good subassemblies with proper coding conventions
5. Tools to for development communication and training – getting the word out

\<ProjectName\>

DesignModel

- 00_SurveyBase
  - Control
  - Queries
  - References
  - SourceData
    - LiDAR
    - GPS
    - Photogrammetry
    - Total Station
    - CAiCE
  - SurveyDatabases
  - SurveyDrawingProduction
- 01_ExistingSurfaces
  - SourceData
- 02_Geometry
  - SourceData
- 03_Corridors
- 04_ProposedSurfaces
- 05_NotUsed
- 06_DrainageUtilities
  - SourceData
- 07_Orthoimagery
- 08_References
  - _Shortcuts
- 09_Construction
- 10_SubDisciplines
  - ConstructionStaging
  - ElectricalLighting
  - Environmental
  - Geotechnical
  - Landscaping
  - Structural
- 20_Working
- 21_Transfer

DrawingProduction

- _SheetSetManagerDST
- 000_CoverKeyplanLegend
- 100_PlanDrawings
- 100_RW_PropertyAcquisition
- 200_ProfileDrawings
- 300_TypicalSections
- 350_Details
- 400_GeometricsLaning
- 500_SpotElevations
- 600_SignagePavementMarkings
- 700_DrainageUtilities
- 800_VolumeOverhaul
- 900_GravelQuantityHaulChart
- 1000_DesignSections
- 1100_SubDisciplines
  - ConstructionStaging
    - Drainage
    - Preload
    - TrafficManagement
  - ElectricalLighting
  - Environmental
  - Geotechnical
  - Landscaping
  - Structural
- 2000_Working
- 2100_Transfer

Civil 3D Survey Database Data Sharing - SDB

Design Model Drawings

1. Survey figures and points inserted to SURVBASE drawing for base plan creation *

2. Survey figures and points inserted to EXSURF drawing for existing surface modeling **

3. Survey figures inserted to CORR drawing(s) for corridor targeting ** (or attach CORR as Xref)

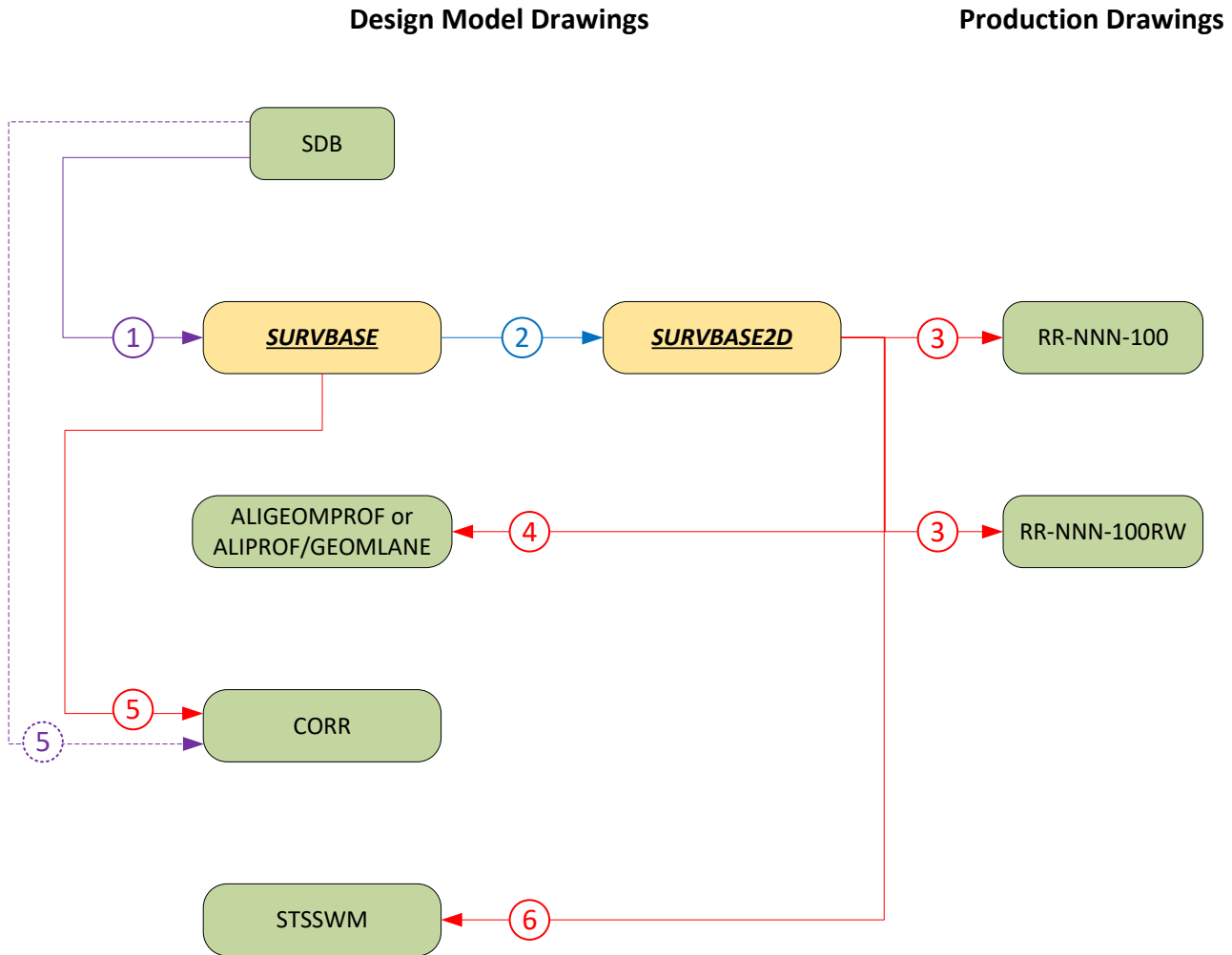4. Survey figures inserted to SECT drawing for section view annotation **

——————————————— AutoCAD Xref Overlay

——————————————— Survey Database

* Refer to Survey Model and Production Drawings Diagram

** Grid to ground transformation settings required if SDB in grid

Civil 3D Survey Base Drawing Data Sharing - SURVBASE
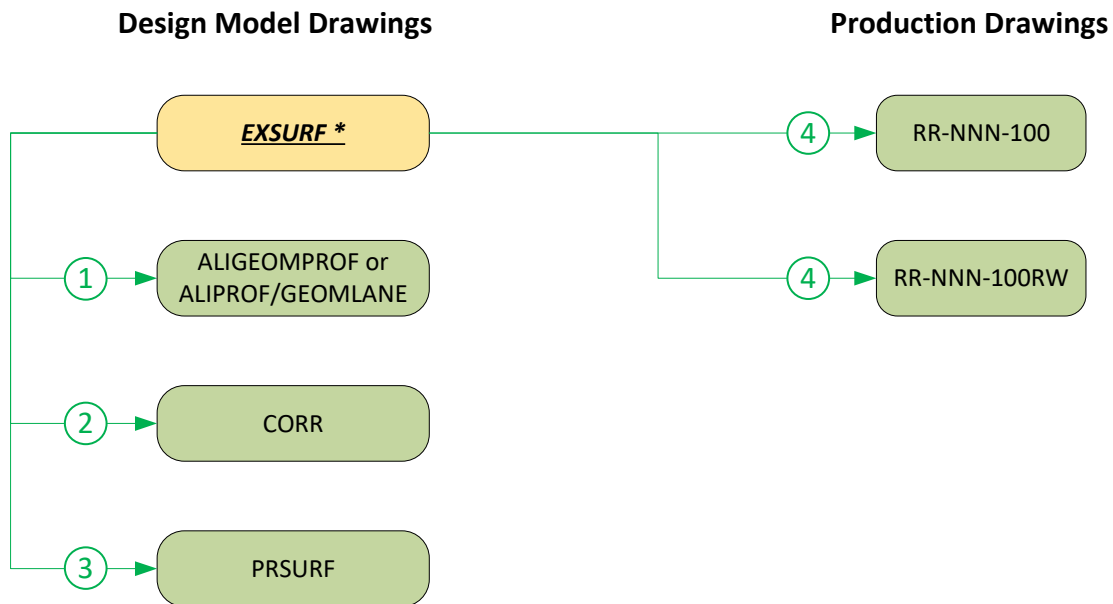
Design Model Drawings

Production Drawings

① Survey figures and points inserted to SURVBASE from SDB for base plan creation *

② Create SURVBASE2D 2D drawing from SURVBASE

③ 100 and 100RW Series production drawings attach SURVBASE2D as Xref to show existing geometry

④ ALIGEOMPROF (or ALIPROF and GEOMLANE) attaches SURVBASE2D as Xref for proposed geometry tie ins

⑤ CORR attaches SURVBASE as Xref for corridor targeting (or insert survey figures from SDB)

⑥ STSSWM attaches SURVBASE2D as Xref for utility layout

——————————— AutoCAD Xref Overlay

——————————— Survey Database

* Refer to Survey Model and Production Drawings Diagram for details

Civil 3D Survey Existing Surfaces Drawing Data Sharing - EXSURF

Design Model Drawings

Production Drawings

```
                EXSURF *                    ④ →  RR-NNN-100

      ① →   ALIGEOMPROF or                 ④ →  RR-NNN-100RW
            ALIPROF/GEOMLANE

      ② →      CORR

      ③ →     PRSURF
```

① ALIGEOMPROF (or ALIPROF) references surface objects from EXSURF for surface profile creation

② CORR references surface objects for corridor targeting

③ PRSURF references surface objects for combined existing and proposed surface creation for subgrade, top of granular and finished grade

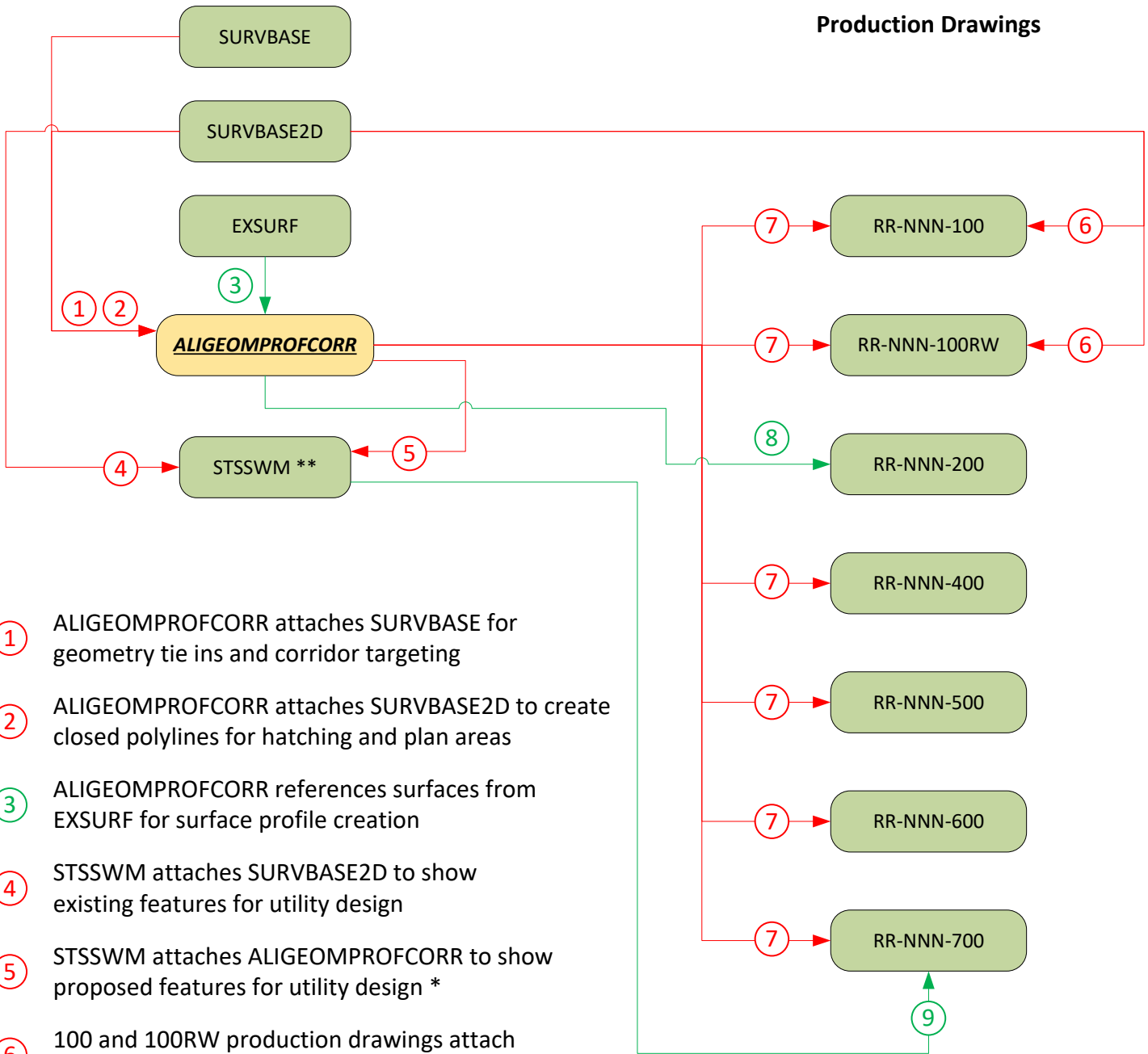④ 100 and 100RW production drawings reference existing surface to show contours and contour labels

——————————— Civil 3D Reference Object

* Refer to Survey Model and Production Drawings Diagram

Civil 3D ALIGEOMPROFCORR Drawing Data Sharing (Option 1)

Design Model Drawings

Production Drawings

① ALIGEOMPROFCORR attaches SURVBASE for geometry tie ins and corridor targeting

② ALIGEOMPROFCORR attaches SURVBASE2D to create closed polylines for hatching and plan areas

③ ALIGEOMPROFCORR references surfaces from EXSURF for surface profile creation

④ STSSWM attaches SURVBASE2D to show existing features for utility design

⑤ STSSWM attaches ALIGEOMPROFCORR to show proposed features for utility design *

⑥ 100 and 100RW production drawings attach SURVBASE2D to show existing geometry

⑦ 100, 100RW, 400, 500, 600, 700 production drawings attach ALIGEOMPROFCORR to show proposed geometry *

⑧ 200 production drawing references profiles from ALIGEOMPROFCORR

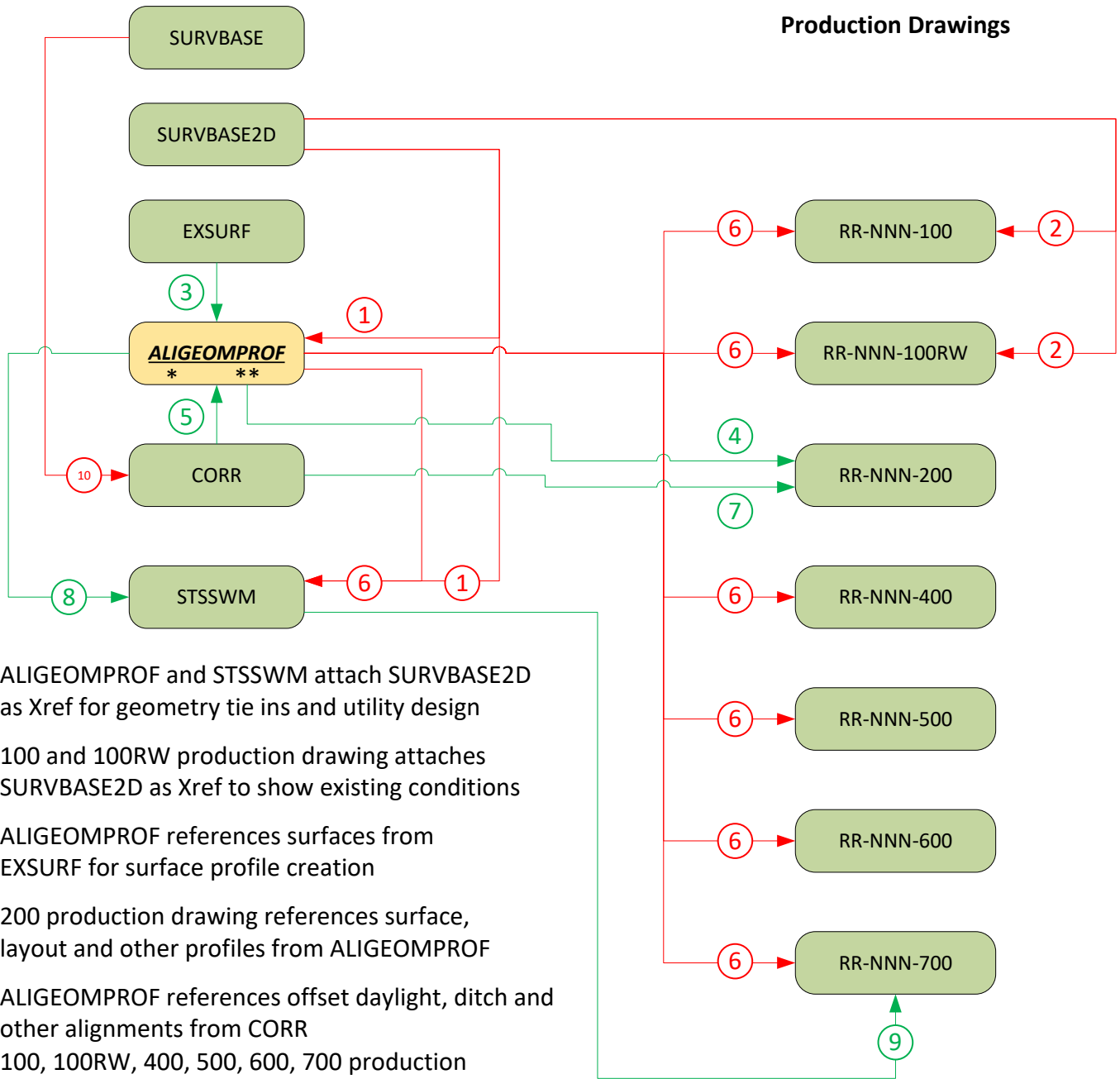⑨ 700 production drawings reference underground utilities from STSSWM (or from ALIGEOMPROFCORR)

———— AutoCAD Xref (Overlays)

———— Civil 3D Reference Object

* Corridor layer turned off
** Optional

Civil 3D Alignment Geometry Profile Drawing Data Sharing (Option 2)

BRITISH COLUMBIA
Ministry of Transportation

Design Model Drawings

Production Drawings

① ALIGEOMPROF and STSSWM attach SURVBASE2D as Xref for geometry tie ins and utility design

② 100 and 100RW production drawing attaches SURVBASE2D as Xref to show existing conditions

③ ALIGEOMPROF references surfaces from EXSURF for surface profile creation

④ 200 production drawing references surface, layout and other profiles from ALIGEOMPROF

⑤ ALIGEOMPROF references offset daylight, ditch and other alignments from CORR

⑥ 100, 100RW, 400, 500, 600, 700 production drawings and STSSWM attach ALIGEOMPROF as Xref

⑦ 200 production drawing references ditch and other offset profiles from CORR

⑧ STSSWM references alignment and profile from ALIGEOMPROF for utility design

⑨ 700 production drawings reference underground utilities from STSSWM

⑩ CORR attaches SURVBASE as Xref for corridor targeting (or insert survey figures from SDB)

——————— AutoCAD Xref (Overlays)
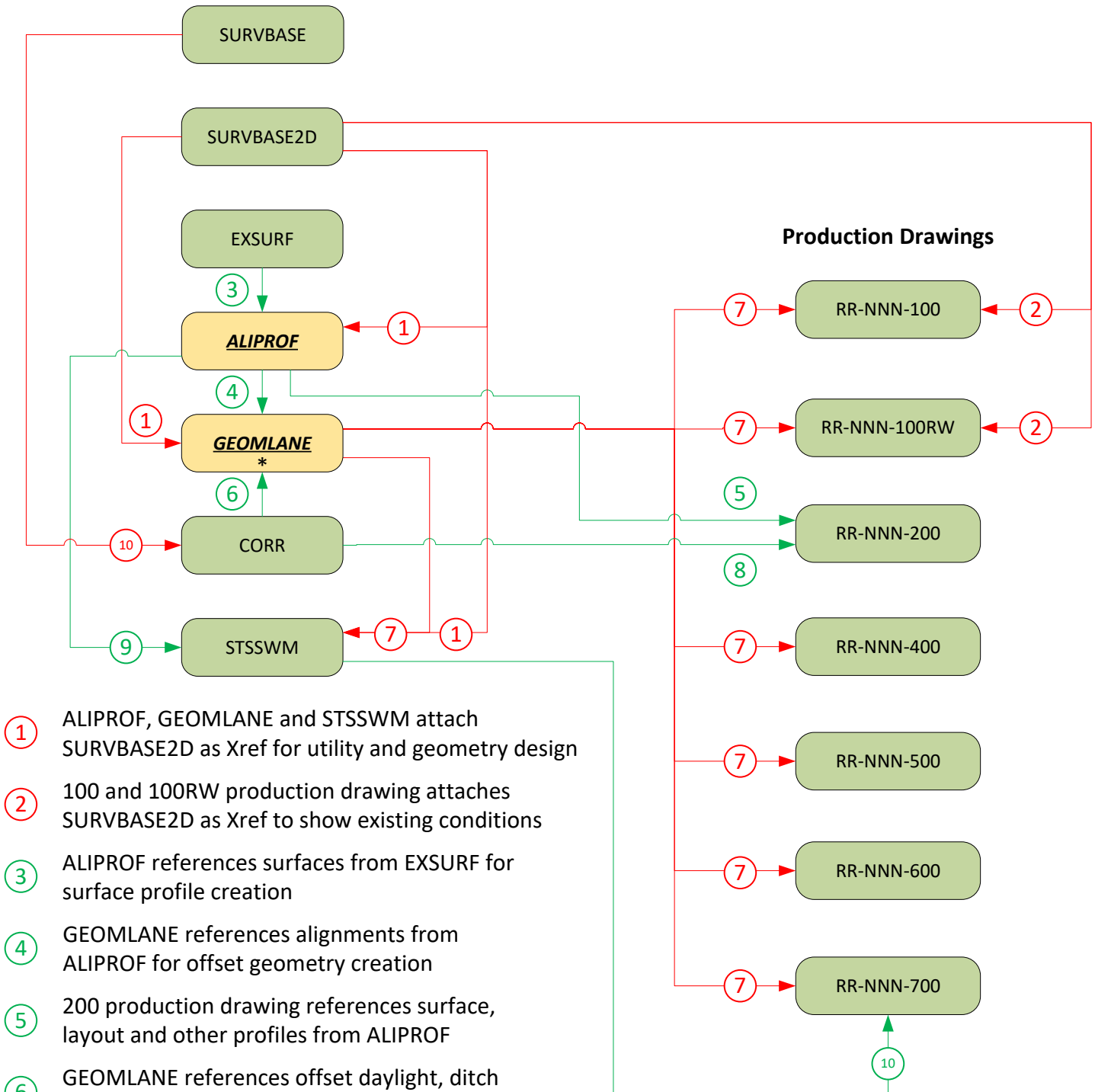
——————— Civil 3D Reference Object

* Use Civil 3D Plan Production Tools to create View Frame Groups for 100, 100RW, 200, 400, 500, 600 and 700 production drawings

** ALIPROF and GEOMLANE drawings can replace ALIGEOMRPOF and be used to separate alignments and profiles from offset geometry

Civil 3D Alignment Profile Drawing Data Sharing (Option 3)

Design Model Drawings

SURVBASE

SURVBASE2D

EXSURF

③

ALIPROF ← ①

④

① → *GEOMLANE*
*

⑥

CORR

⑩ →

⑨ → STSSWM ← ⑦ ①

Production Drawings

⑦ → RR-NNN-100 ← ②

⑦ → RR-NNN-100RW ← ②

⑤ → RR-NNN-200
⑧

⑦ → RR-NNN-400

⑦ → RR-NNN-500

⑦ → RR-NNN-600

⑦ → RR-NNN-700

⑩

① ALIPROF, GEOMLANE and STSSWM attach SURVBASE2D as Xref for utility and geometry design

② 100 and 100RW production drawing attaches SURVBASE2D as Xref to show existing conditions

③ ALIPROF references surfaces from EXSURF for surface profile creation

④ GEOMLANE references alignments from ALIPROF for offset geometry creation

⑤ 200 production drawing references surface, layout and other profiles from ALIPROF

⑥ GEOMLANE references offset daylight, ditch and other alignments from CORR

⑦ 100, 100RW, 400, 500, 600, 700 production drawings and STSSWM attach GEOMLANE as Xref

⑧ 200 production drawing references ditch and other offset profiles from CORR

⑨ STSSWM references alignment and profile from ALIPROF for utility design

⑩ CORR attaches SURVBASE as Xref for corridor targeting (or insert survey figures from SDB)

——————— AutoCAD Xref (Overlays)

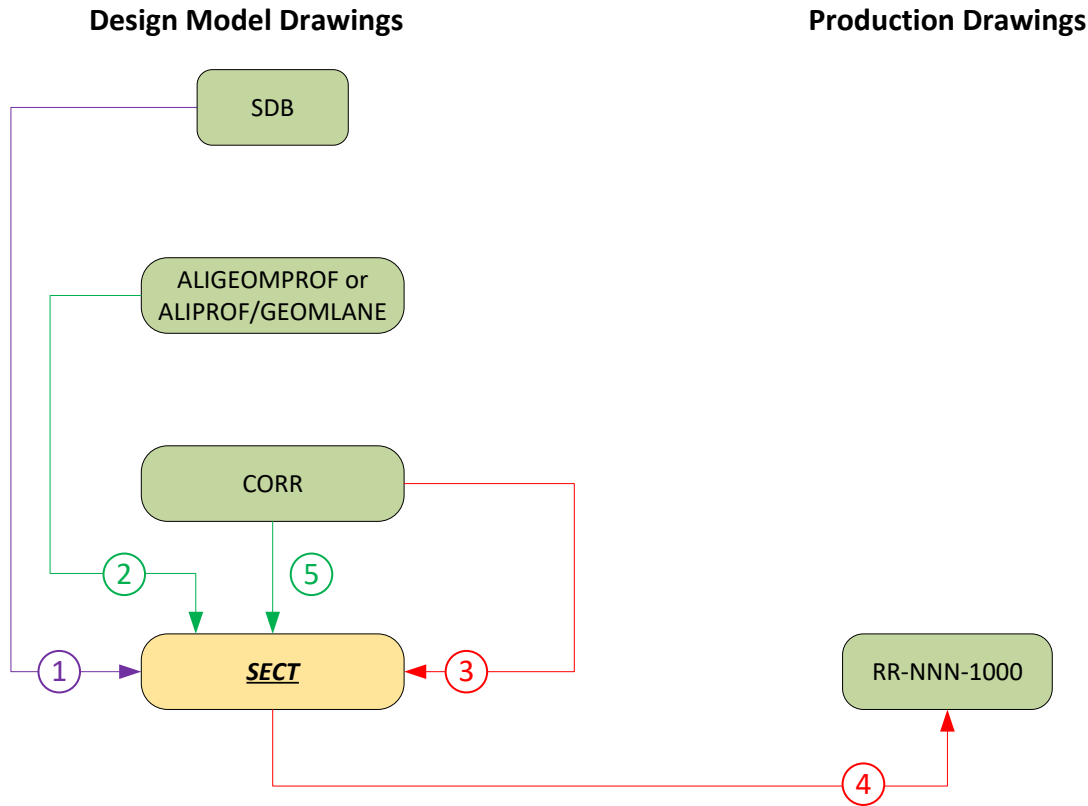——————— Civil 3D Reference Object

* Use Civil 3D Plan Production Tools to create View Frame Groups for 100, 100RW, 200, 400, 500, 600 and 700 production drawings

Civil 3D Corridor Drawings Data Sharing CORR

Design Model Drawings

Design Model Drawings
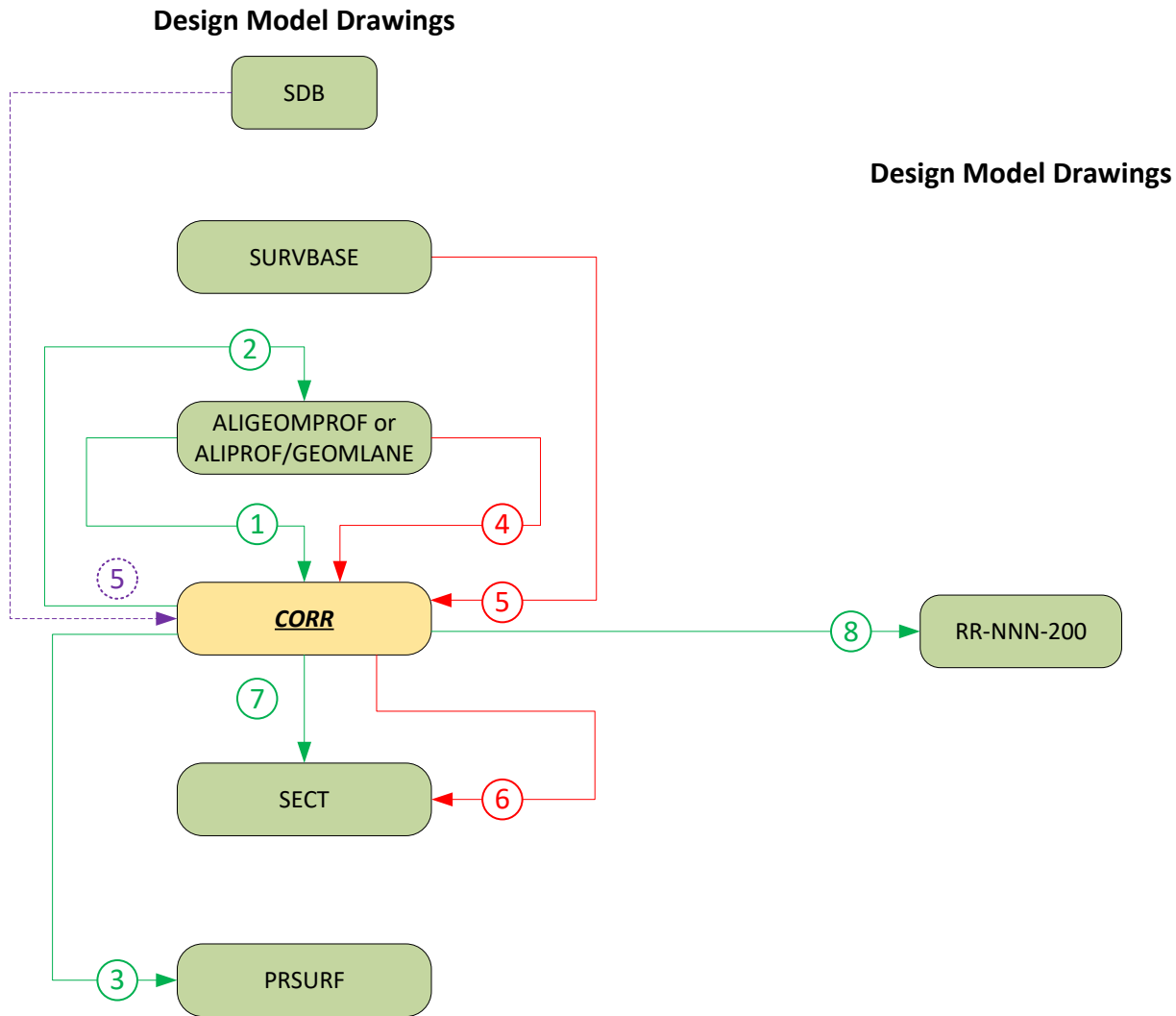
1. CORR references alignments and profiles from ALIGEOMPROF (or ALIPROF) for corridor modeling

2. ALIGEOMPROF (or GEOMLANE) references daylight and ditch alignments and offset profiles from CORR

3. PRSURF drawing references corridor surfaces top, and tops of granular/subgrade from CORR

4. CORR attaches ALIGEOMPROF (or GEOMLANE) as Xref for corridor targeting

5. CORR attaches SURVBASE as Xref for corridor targeting (optionally insert figures from SDB)

6. SECT attaches CORR as Xref for sample line and section view production

7. SECT attaches CORR as reference object for sample line and section view production (2017 and later versions only as better alternative to 6 above)

8. 200 Production drawing references offset profiles created from CORR

———————————— AutoCAD Xref (Overlays)

———————————— Civil 3D Reference Object

Civil 3D Section Drawings Data Sharing – SECT

Design Model Drawings

Production Drawings

SDB

ALIGEOMPROF or
ALIPROF/GEOMLANE

CORR

② ⑤

① **_SECT_** ③

④

RR-NNN-1000

① SECT insert figures from survey database for section view insertion and annotation *

② SECT references alignments from ALIGEOMPROF (or ALIPROF) for sample line and section view generation

③ SECT attaches CORR as Xref for surface, corridor surface and corridor section data

④ 1000 series production drawing(s) attach SECT as Xref

⑤ SECT attaches CORR as reference object for sample line and section view production (2017 and later versions only as preferred alternative to 3 above)

—————— AutoCAD Xref (Overlays)

—————— Civil 3D Reference Object

—————— Survey Database

* Grid to ground transformation settings required if SDB in grid

Civil 3D Proposed Surface Drawings Data Sharing - PRSURF
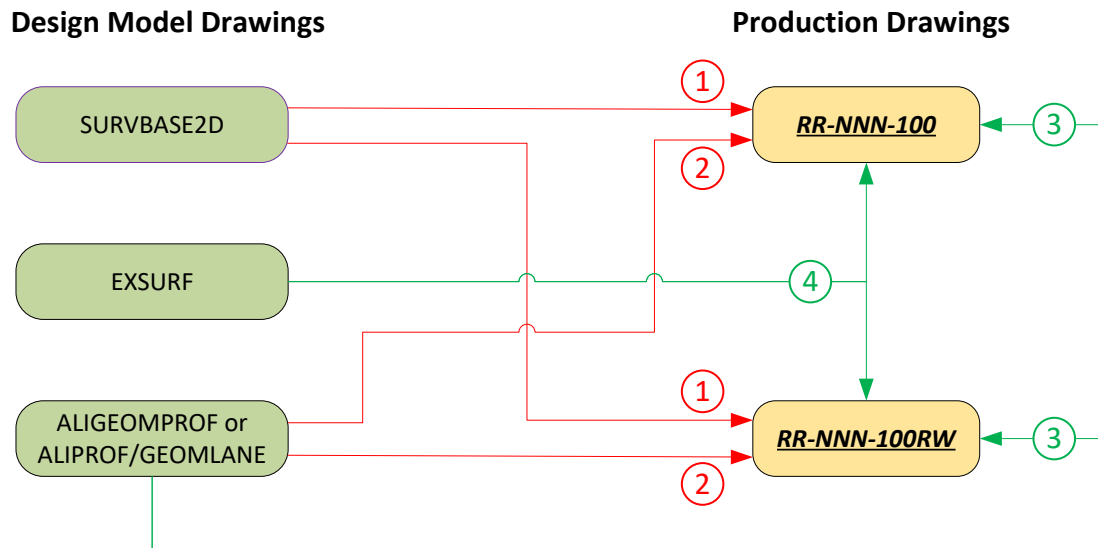
Design Model Drawings

Production Drawings
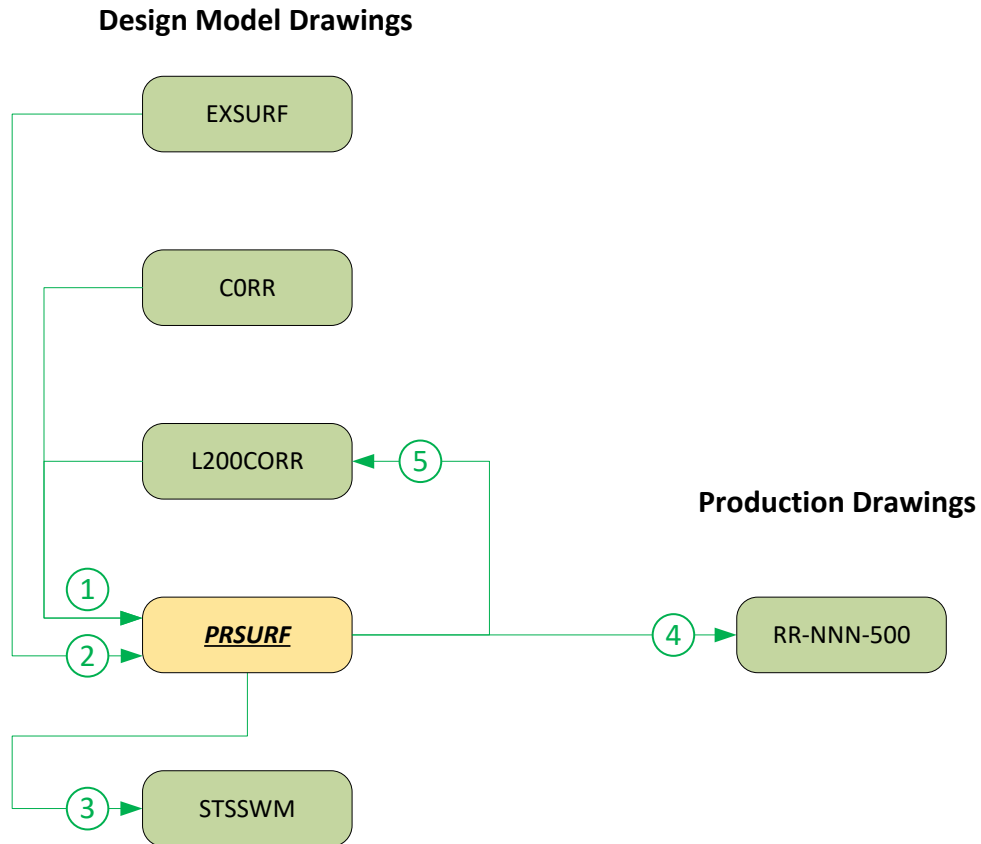
① PRSURF references proposed surfaces (top, top of granular, top of subgrade) from CORR drawings

② PRSURF references existing surfaces from EXSURF for combined existing and proposed surface

③ STSSWM (Drainage and Utilities) references proposed combined surfaces from PRSURF

④ 500 production drawing references proposed surface from PRSURF

⑤ L200 (other corridor) corridor drawings reference proposed surfaces from PRSURF

———————— Civil 3D Reference Object

Civil 3D Plan Drawing Data Sharing
100 Plan Series

Design Model Drawings　　　　　　　　　**Production Drawings**

SURVBASE2D

EXSURF

ALIGEOMPROF or
ALIPROF/GEOMLANE

RR-NNN-100

RR-NNN-100RW

① 100 production drawing(s) reference SURVBASE2D as Xref to show existing conditions

② 100 production drawing(s) reference ALIGEOMPROF (or GEOMLANE) as Xref to show proposed geometry

③ 100 production drawing(s) reference alignments from ALIGEOMPROF (or ALIPROF) for annotation

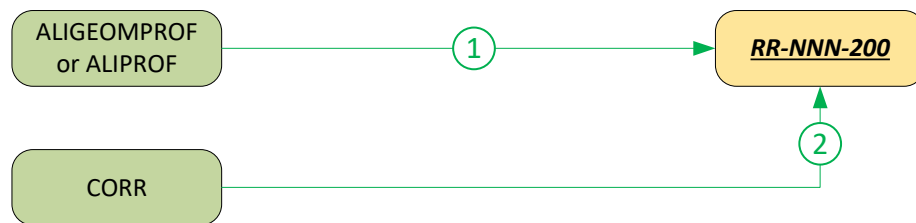④ 100 production drawing(s) reference surface from EXSURF to show existing contours and labels

———————————— AutoCAD Xref (Overlays)

———————————— Civil 3D Reference Object

Civil 3D Profile Drawing Data Sharing
200 Profile Series

Design Model Drawings   **Production Drawings**

```
┌─────────────────┐                          ┌─────────────────┐
│  ALIGEOMPROF    │────────①───────────────▶│  RR-NNN-200     │
│  or ALIPROF     │                          └─────────────────┘
└─────────────────┘                                  ▲
                                                     ②
┌─────────────────┐                                  │
│     CORR        │──────────────────────────────────┘
└─────────────────┘
```

① 200 production drawing(s) reference profiles and alignments from ALIGEOMPROF (or ALIPROF)

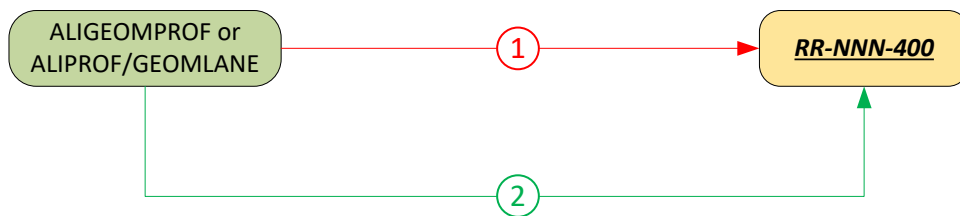② 200 production drawing(s) reference offset profiles from CORR drawing

————————————————— Civil 3D Reference Object

Civil 3D Geometrics and Laning Drawing Data Sharing
400 Geometrics and Laning Series

Design Model Drawings   **Production Drawings**

```
┌─────────────────────┐              ①              ┌─────────────┐
│  ALIGEOMPROF or     │ ─────────────────────────▶  │ RR-NNN-400  │
│  ALIPROF/GEOMLANE   │                              └─────────────┘
└─────────────────────┘                                   ▲
         │                      ②                          │
         └──────────────────────────────────────────────┘
```

① 400 production drawing(s) reference ALIGEOMPROF (or GEOMLANE) as Xref to show proposed geometry and pavement markings

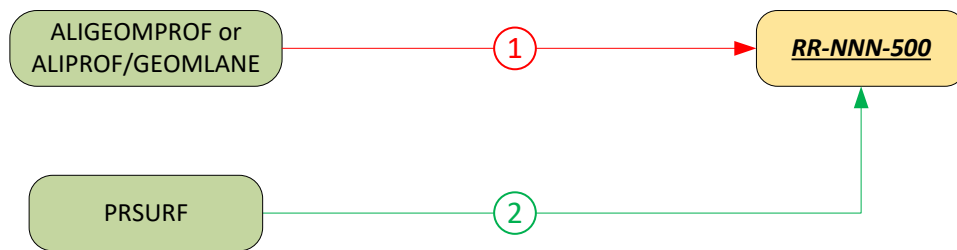② 400 production drawing(s) reference alignments from ALIGEOMPROF (or ALIPROF) for annotation

——————————— AutoCAD Xref (Overlays)

——————————— Civil 3D Reference Object

Civil 3D Spot Elevation Drawing Data Sharing

500 Spot Elevations Series

Design Model Drawings   **Production Drawings**

```
┌──────────────────────┐                    ┌──────────────────────┐
│  ALIGEOMPROF or       │ ──────①──────────→ │   RR-NNN-500         │
│  ALIPROF/GEOMLANE     │                    │                      │
└──────────────────────┘                    └──────────────────────┘
                                                       ↑
┌──────────────────────┐                               │
│      PRSURF          │ ──────②──────────────────────┘
└──────────────────────┘
```

① 500 production drawing(s) reference ALIGEOMPROF (or GEOMLANE) to show proposed geometry

② 500 production drawing(s) reference proposed surfaces from PRSURF for elevation labels

―――――――――――――   AutoCAD Xref (Overlays)

―――――――――――――   Civil 3D Reference Object

Civil 3D Signage and Pavement Marking Drawing Data Sharing
600 Signage and Pavement Markings Series

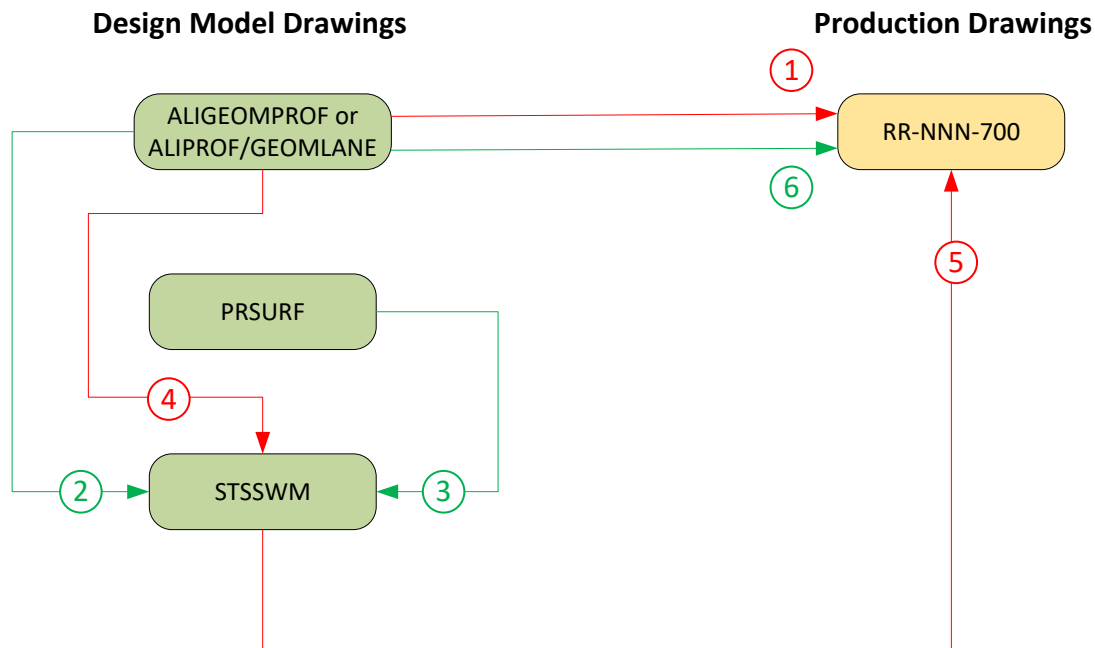**Design Model Drawings**   **Production Drawings**

① 600 production drawing references ALIGEOMPROF (or GEOMLANE) as Xref to show proposed geometry and pavement markings (sign symbols in 600 drawing)

② 600 production drawing references alignments from ALIGEOMPROF (or ALIPROF) for alignment annotation

——————————— AutoCAD Xref (Overlays)

——————————— Civil 3D Reference Object

Civil 3D Drainage and Utilities (STM, SAN, WAT) Drawing Data Sharing

700 Drainage and Utilities Series


① 700 production drawing(s) reference ALIGEOMPROF (or GEOMLANE) as Xref to show proposed geometry

② STSSWM drawing references alignments and profiles from ALIGEOMPROF (or ALIPROF)

③ STSSWM drawing references TOP surface (or combined TOP and OG) from PRSURF

④ STSSWM drawing references ALIGEOMPROF (or GEOMLANE) as Xref for utility design

⑤ 700 production drawing(s) reference STSSWM as Xref to show proposed geometry

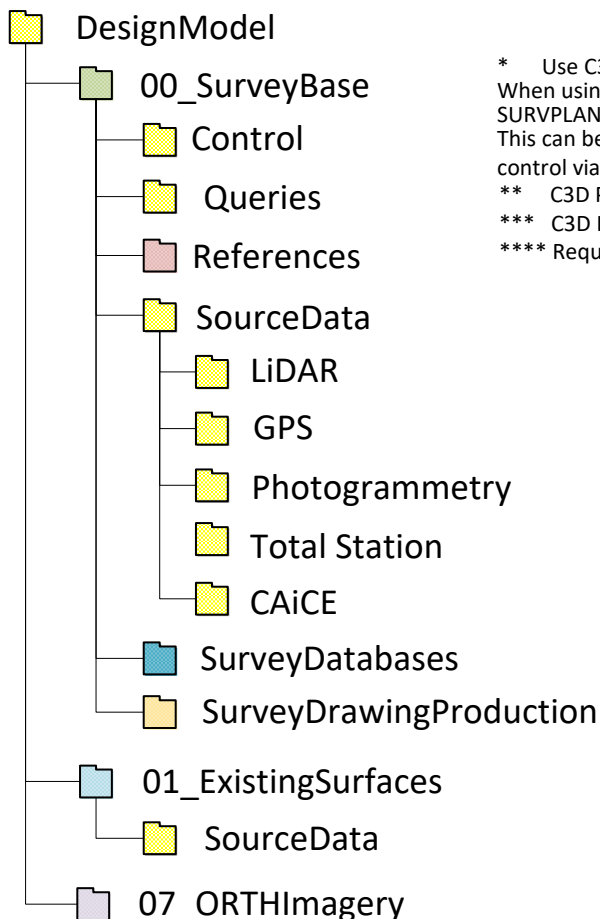⑥ 700 production drawing(s) references alignment from ALIGEOMPRO (or ALIPROF) for annotation

———————————— AutoCAD Xref (Overlays)

———————————— Civil 3D Reference Object

Civil 3D Survey Model and Production Drawing Data Sharing

Design Model Drawings
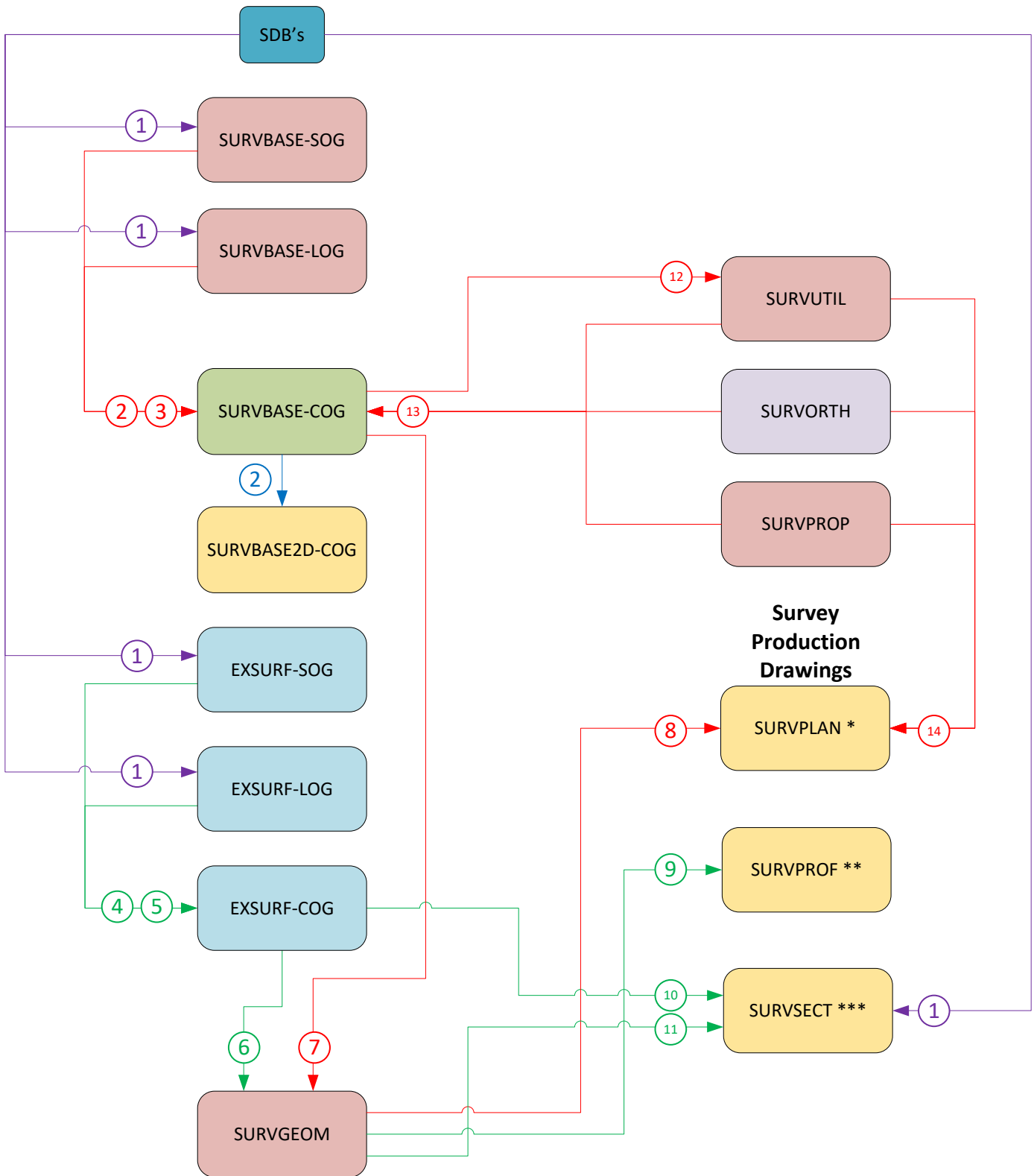
Civil 3D Survey Model and Production Drawing Data Sharing

① Figures and points inserted from SDB for SURVBASE creation, EXSURF modeling and section view figure projections. Alternatively original ground surface models can be created using survey queries.

② SURVBASE-COG attaches SURVBASE-SOG as Xref for base plan creation (Xref *attachment*)

③ SURVBASE-COG attaches SURVBASE-LOG as Xref for base plan creation (Xref *attachment*)

④ EXSURF-COG references SOG surface from EXSURF-SOG

⑤ EXSURF-COG references LOG surface from EXSURF-LOG

⑥ SURVGEOM references COG surface from EXSURF-COG for existing surface profile creation

⑦ SURVGEOM attaches SURVBASE-COG as Xref for existing geometry creation

⑧ SURVPLAN production drawing attaches SURVGEOM as Xref to show existing features and alignments

⑨ Survey PROFILE production drawing references existing alignments and surface profiles from SURVGEOM

⑩ Survey SECT production drawing references COG surface from EXSURF-COG

⑪ Survey SECT production drawing references existing alignments from SURGEOM

⑫ SURVUTIL attaches SURVBASE-COG as Xref (Xref *overlay*)

⑬ SURVBASE-COG attaches SURVPROP, SURVUTIL and SURVORTH as Xref (Xref *attachment*, SURVORTH Unloaded) ****

⑭ SURVPLAN attaches SURVUTIL, SURVORTH and SURVPROP as Xref

⑮ Create SURVBASE2D 2D drawing from SURVBASE

📁 **DesignModel**
 📁 **00_SurveyBase**
  📁 **Control**
  📁 **Queries**
  📁 **References**
  📁 **SourceData**
   📁 **LiDAR**
   📁 **GPS**
   📁 **Photogrammetry**
   📁 **Total Station**
   📁 **CAiCE**
  📁 **SurveyDatabases**
  📁 **SurveyDrawingProduction**
 📁 **01_ExistingSurfaces**
  📁 **SourceData**
 📁 **07_ORTHImagery**

* Use C3D Plan Production Tools from SURVGEOM to create sheets in SURVPLAN drawing. When using plan production tools the alignment is also created as a reference object in SURVPLAN, meaning there is a duplicate display of the alignment in the SURVPLAN drawing. This can be alleviated by turning the Xref alignment layer off, which then gives full annotation control via the reference object in the SURVPLAN drawing

** C3D Plan Production Tools from SURVGEOM to create sheets in SURVPROF drawings

*** C3D Plan Production Tools in SECT drawing to create sheets

**** Required for survey project delivery to design