Civil Site Design - Alignments and Intersections

Alignments are integral to the software. In AutoCAD and BricsCAD versions, you use the Alignment tools to create alignments from polylines, then use the alignment editing tools to make changes. In Civil 3D, the software works by reading Civil 3D alignments in the drawing to obtain horizontal geometry controls for all features including:

- Road centrelines
- Strings/profiles
- Kerb returns
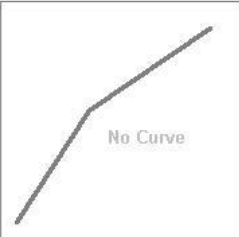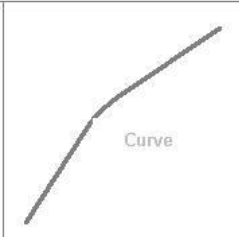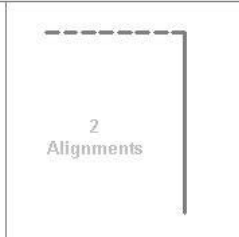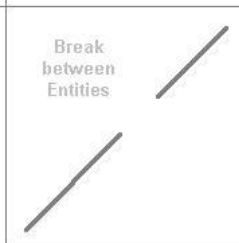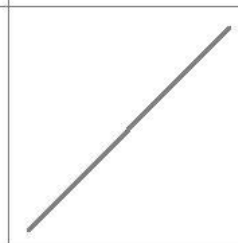- Cul-de-sacs
- Knuckles
- Roundabouts and Off Ramps

Roads, Kerb Returns, Cul-de-sacs or Knuckle are design objects which the software has analysed and included in its own database for editing and use in profile design and generation of a trimmed surface model as well as cross section and long section output.

*Note: **Civil Site Design** has been designed to automate the alignment and profile design aspects of kerb returns, cul-de-sacs and knuckles.*
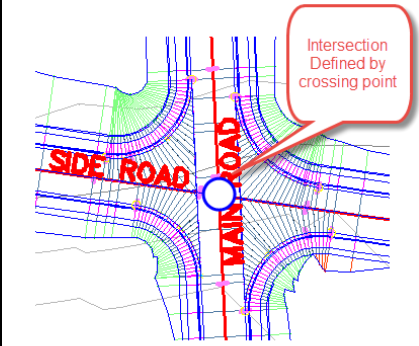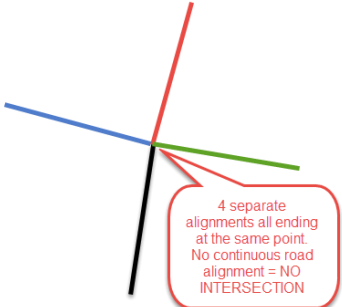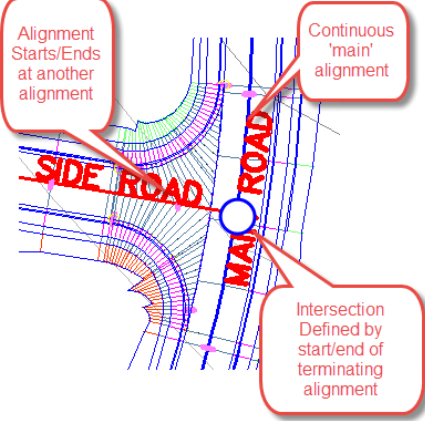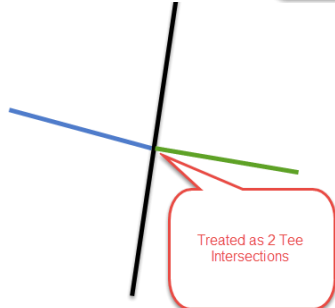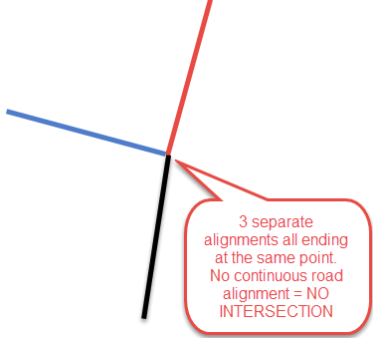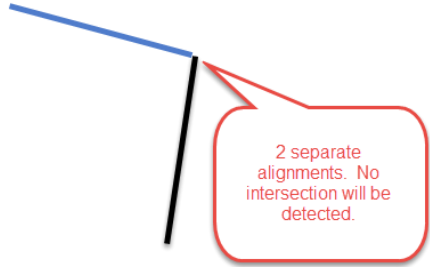
Alignment Geometry

- Geometrically, the alignment needs to be connected. Civil 3D allows you to have unconnected alignments, however this will not be accepted by the **Civil Site Design** software.
- Automated intersection requirements
    - The Centreline of Side Road alignments should ALWAYS be SNAPPED onto the Centreline of any Main Road alignment - otherwise the software may not interpret them as 'connecting'
    - Crossing Alignments are acceptable in the software
    - For every Intersection
        - There must be sufficient alignment length in every direction beyond the intersection point. The current requirement is that at least one alignment must extend a minimum of 5m past the intersection point
        - Kerb Return creation
            - The kerb return connection algorithm iteratively runs up and down the Intersection Connection code (normally LEB/REB, or LETW/RETW for USA installations) to find a connection point. These codes must exist on the two roads and extend right through the intersection zone
            - The main and side road centrelines are used for the start/end directions of the kerb return alignment (unless you specify your own alignment).
            - To find a connection, **at least** two sampled sections must be added beyond the connections of the kerb return, on both the main and side road. So, for 10m spacings, each road must extend 20m past the kerb return start/end locations
- Stub Roads - see the above information for Intersections
- Alignments, in general, should be at least 30 metres (100 feet) long to satisfy most intersection requirements
- Loop Roads
    - Do not create alignments that loop back on themselves (such as a 'P' shaped alignment) - the software requires the Side Road to connect to a different alignment from the Main Road/s
    - The best way to handle looped roads is to break them (have two separate alignments that share an end/start point) at a convenient point so that there is not a loop. In order to ensure continuity, the Designer will need to ensure the vertical grading matches at the beak point, otherwise the rest of the processing works as normal.

Special note about intersections: If the Designer moves the alignments so that the intersection point goes outside a 10 meter (30') radius from the original location, then a new point is created and the system will go looking for a new kerb return alignment and corridor (because essentially you are creating a new design).
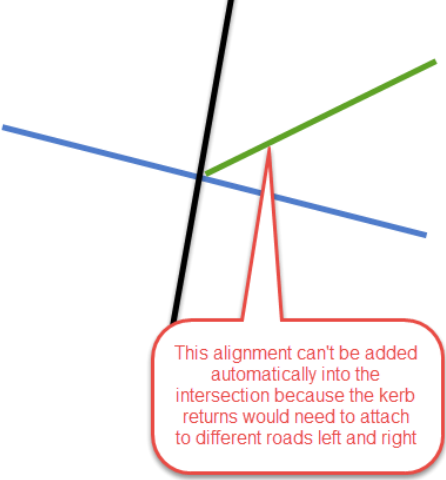
Alignments and Intersections

Below are different intersection configurations that are AUTOMATICALLY recognised by the software when the alignments are turned into ROAD strings and contain the Intersection Connection Code left and right of the centreline (LEB/REB by default for metric users, and LETW/RETW for imperial users)

Intersection Type	Correct	Incorrect
Cross Roads		
Tee Intersections		

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Notes:
- The main alignment should NOT have an IP (PI) at the exact intersect with the side road UNLESS it is supported with a horizontal curve.
- The road centerlines should always have horizontal curves at IP's (PVI's)

Intersection Type	Design
5 way plus intersections	This alignment can't be added automatically into the intersection because the kerb returns would need to attach to different roads left and right The fifth 'leg' needs to be modeled in using Strings and Model Builder, including modeling in 2 strings to represent the kerb returns.

Alignment Name
Do not use a comma in the alignment name.

Other Considerations

- Do **not** create multiple Road Strings using alignments that that lie on top of one another - this will create additional intersections and kerb returns which will cause the software to build invalid models. Use the String/Profile command for the overlapping string designs.
- It is recommended that Designer give their alignments the name that they want to have for the Roads - the software will set the Road names to match alignment names. A command does exist for renaming the road if required
- Each alignment must be FULLY contained within the 'Existing' surface for the entire length of the alignment – do not snap the alignment onto the boundary of a surface as the software will be unable to detect the start/end elevation from the terrain
- Station Equations are not used by **Civil Site Design** - expect unusual results or errors if station equations are applied. It is however acceptable and recommended to use a different Starting Station for the alignment (instead of the starting station being zero)

Kerb Alignment Naming Conventions
The default naming convention for Kerb Return alignments is as follows:
For non-crossing alignments:
- '**Main Road Corridor**' - '**Side Road Corridor**' - **Start**/**End** of the Side Road corridor - **Left**/**Right** of the Side Road corridor.
eg: MainOne-SideOne-Start-L, defines the location to be at the intersection of the MainOne and SideOne corridors at the start of the SideOne alignment and on the left of the SideOne alignment

For crossing alignments:

At a cross roads, the software creates a point and gives it a number. This point remains for the whole job and any intersection within 10 metres (30 feet) of that point will use that point number in the identification of the kerb. The convention is the same as for non-crossing alignments but the point number is now appended:
- "**Main Road Corridor**' - '**Side Road Corridor**' - **Start**/**End** - **Left**/**Right** of the Side Road corridor - **P#**, where # is the number of the intersections working from the start of the Side Road corridor.

In the case of a crossing road, the software names the intersection as if the side road was split in two. Therefore, the **Start** is considered to be where the side road is leaving the intersection with the main road, and the **End** is considered to be where the side road is approaching the main road.

eg: MainOne-SideOne-End-L-P1, defines the location to be at the intersection of the MainOne and SideOne corridors at the approach to the MainOne corridor on the left, for the first intersection encountered working from the start of the SideOne alignment