

# Introduction to Alignment Element Design

## Introduction

When designing horizontal or vertical alignments in Civil 3D there are two methods available to locate and join curves, straights and transitions. They can be described as:

1. Design by Intersection Points (IP Method)
2. Design by Elements (Element Method)

This white paper will address the use of the Element Method only. The IP method is explained in a separate white paper.

Also see the short video on the Cadline Community: **Back to Basics 20 – Introduction to Alignment Element Design.**

## Types of Alignment Elements

Geometric elements used in alignment design can be defined as Straights and Curves. Transition curves could be considered as another element type but they are always associated with a curve and cannot be placed in isolation.

## Types of Fixity

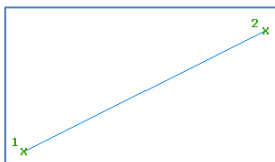
Each type of element can be given an amount of fixity which are: Fixed, Floating and Free. Below are examples of each.

### Fixed Elements:

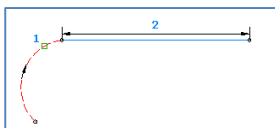
Fixed elements have a completely fixed position in space. Examples of fixed elements are:

#### Fixed Straight – Defined by:

- 2 points

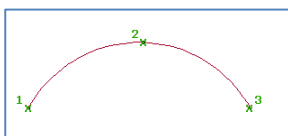


- from curve end, length

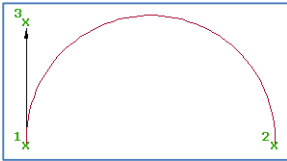


#### Fixed Curves – Defined by:

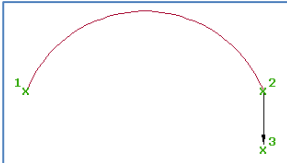
- 3 points



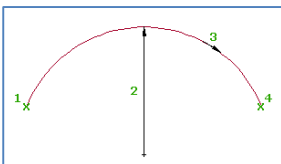
- Two points and a bearing at the first point



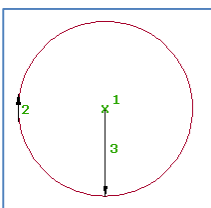
- Two points and a bearing at the second point



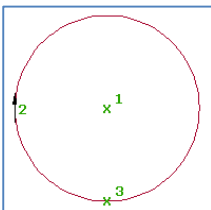
- Two points and a radius



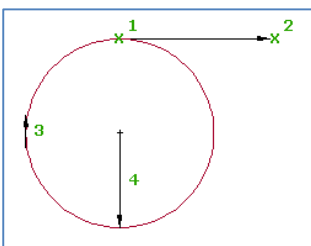
- Centre point and a radius



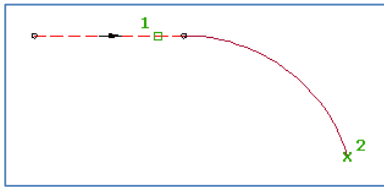
- Centre point, through a point



- Through a point, bearing at a point, and a radius



- From an element end, through a point

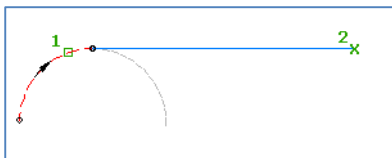


**Floating Elements:**

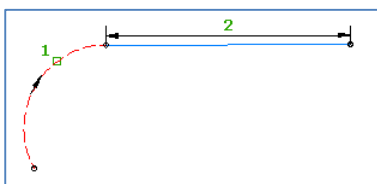
Floating elements have more freedom of movement than fixed elements and are generally floated onto existing fixed elements. Examples of floating elements are:

**Floating Straight – Defined by:**

- From a curve, through a point

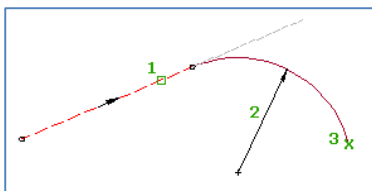


- From a curve end, with a defined length

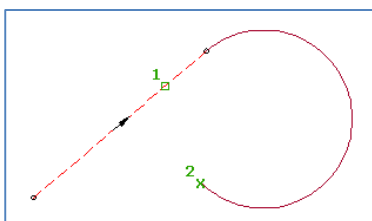


**Floating Curves – Defined by:**

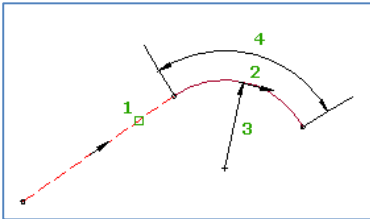
- From an element, radius, through a point



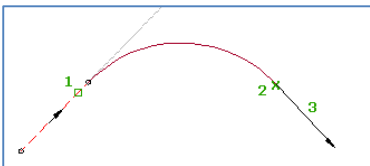
- From an element end, through a point



- From an element end, radius, length



- from an element, through a point, bearing at point

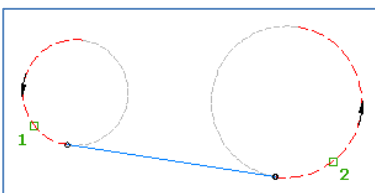
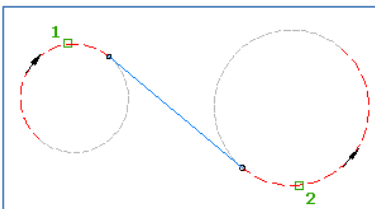
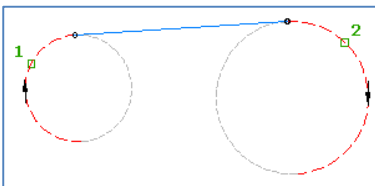


#### Free Elements:

Free elements have the most freedom of movement. They are fitted between fixed or floating elements. Examples of free elements are:

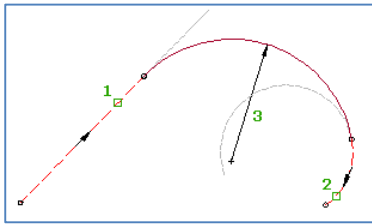
#### Free Straight – Defined by:

- Between two curves

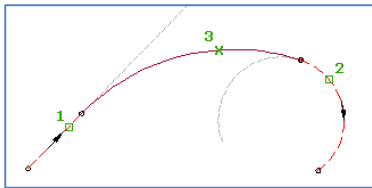


#### Free Curves – Defined by:

- Between two elements, a radius



- Between two elements, through a point



### Advanced Element Design

The methods described above cover the basic usage of Fixed, Floating and Free elements in Element Based Design. More advanced tools that expand on these techniques are also available which will be covered in later white papers. They include:

- Best fit fixed and floating straights
- Best fit fixed, floating and free curves
- Floating straights with transitions
- Floating curves with transitions
- Floating reverse curves with transitions
- Free transition to curve to transition
- Free compound curves with transitions
- Free reverse compound curves with transitions
- Fixed transitions
- Free transitions