masterSERIES

Technical Note

Title: Defining Torsional Loads in MasterFame
& Loading on Asymmetrical members

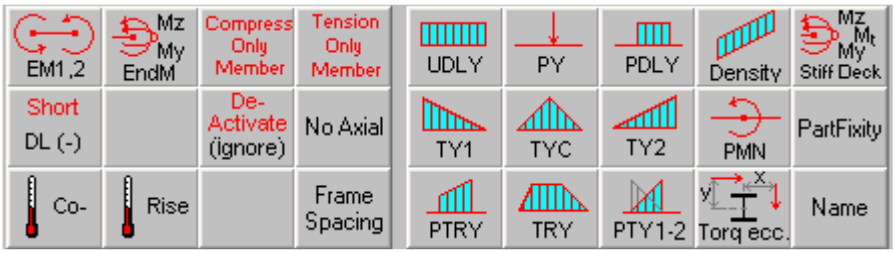
Date: 04/03/2005

Versions: 2003.04+

Program: MasterFrame

With version 2003.04 of the MasterSeries a new load type was introduced to define torsional loads.

The torq eccentricity option is defined like any other load from the loads button array as shown below. The torq ecc. Is not a load itself but defines the eccentricity from the Shear Centre of other member loads.



The torq eccentricity applies to all **subsequent** loads, on the current member, until the torque is changed or reset to zero. The torque eccentricity is initially zero at the start of each beam (ie it does NOT carry forward onto the next beam). This means that virtually any physical load can be defined with a torsional offset.

Typical set of loads

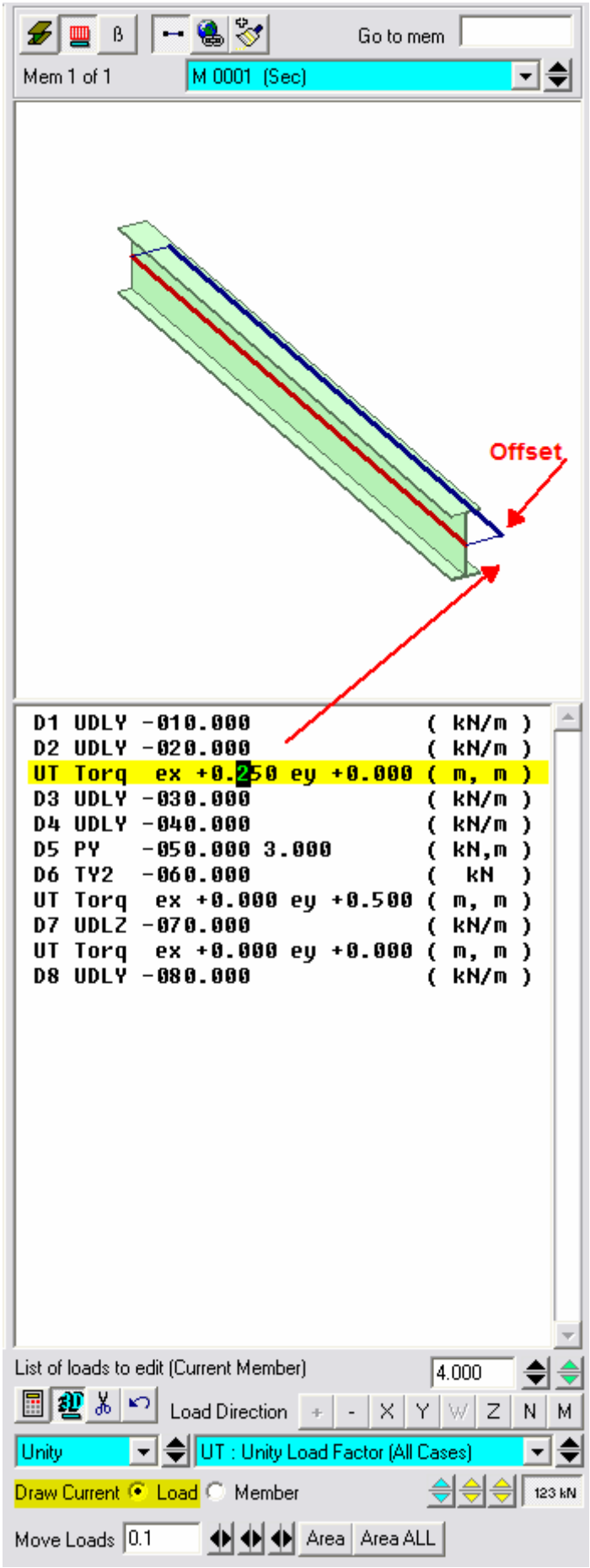
```
D1 UDLY -010.000              ( kN/m )
D2 UDLY -020.000              ( kN/m )
UT Torq  ex +0.250 ey +0.000 ( m, m )
D3 UDLY -030.000              ( kN/m )
D4 UDLY -040.000              ( kN/m )
D5 PY   -050.000 ey +0.000    ( kN,m )
D6 TY2  -060.000              (  kN  )
UT Torq  ex +0.000 ey +0.500 ( m, m )
D7 UDLZ -070.000              ( kN/m )
UT Torq  ex +0.000 ey +0.000 ( m, m )
D8 UDLY -080.000              ( kN/m )
```

In the above set of loads the load groups are assigned to D1 to D8 for ease of reference.

D1 to D2 are applied concentrically at Shear Centre
D3 to D6 are applied with a 250 mm horizontal eccentricity from the Shear Centre
D7 has a 500 mm vertical eccentricity from the Shear Centre
D8 is again applied concentrically at Shear Centre

Tips

1) Always use a UT load factor with a Torq input
2) Always insert a Torque with no offsets at the end. This means if you later apply another load then it will not be offset by mistake
3) If you rotate the frame into an isometric view and highlight the Torq load then the load diagram above the loads input area will indicate the direction of offset as shown opposite



Loading on Asymmetrical members

By default all loads are assumed to induce no local torsion on the member.

To do this it is assumed that the load is applied through the SHEAR CENTRE. Therefore all torq eccentricity's are measured from the Shear Centre.

The centroid and shear are coincident for Doubly symmetrical sections but not for **L'**s, **[**'s, **T**'s, and built up sections.

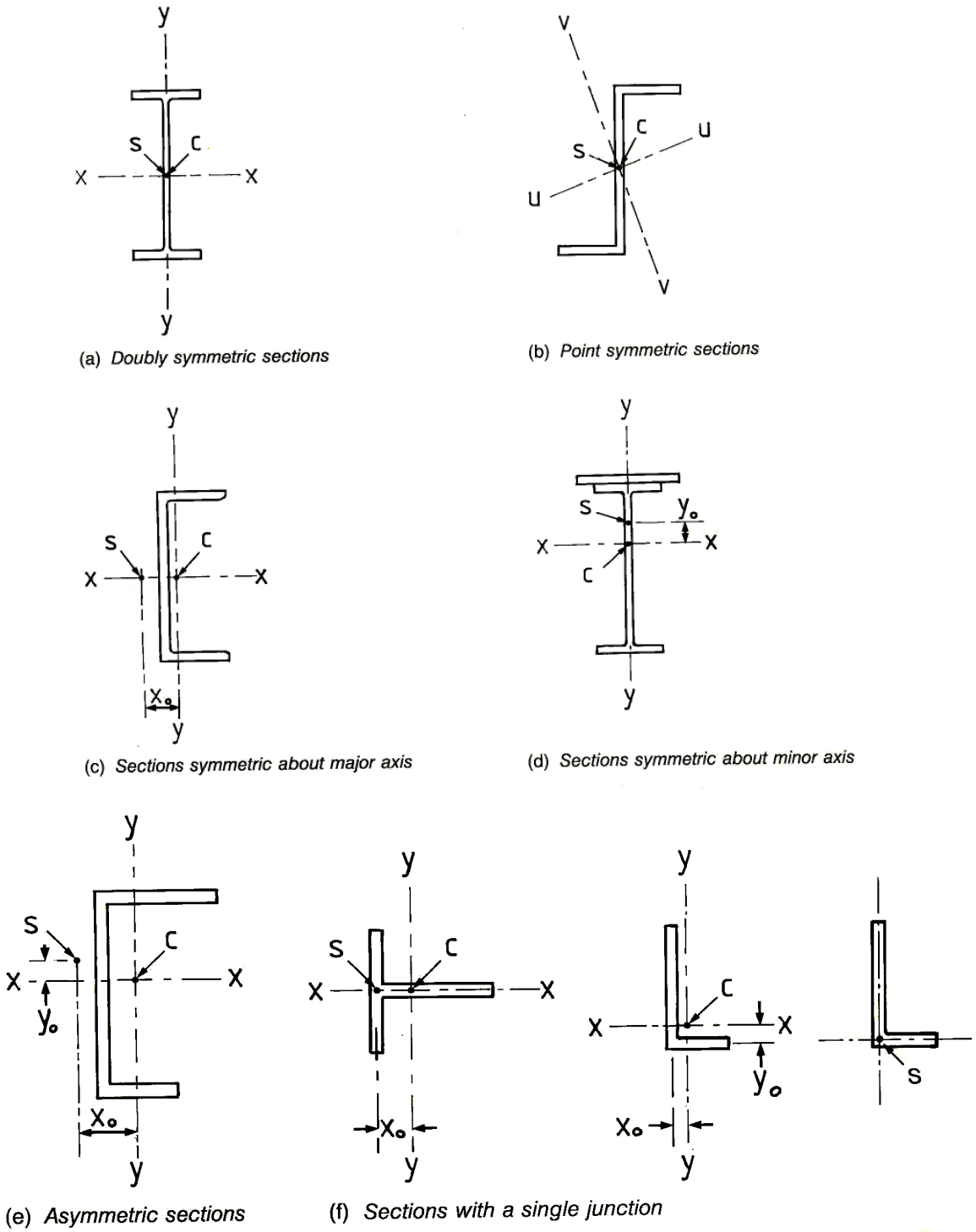


Figure 2.1 *Shear centre 's' and centroid 'c'*

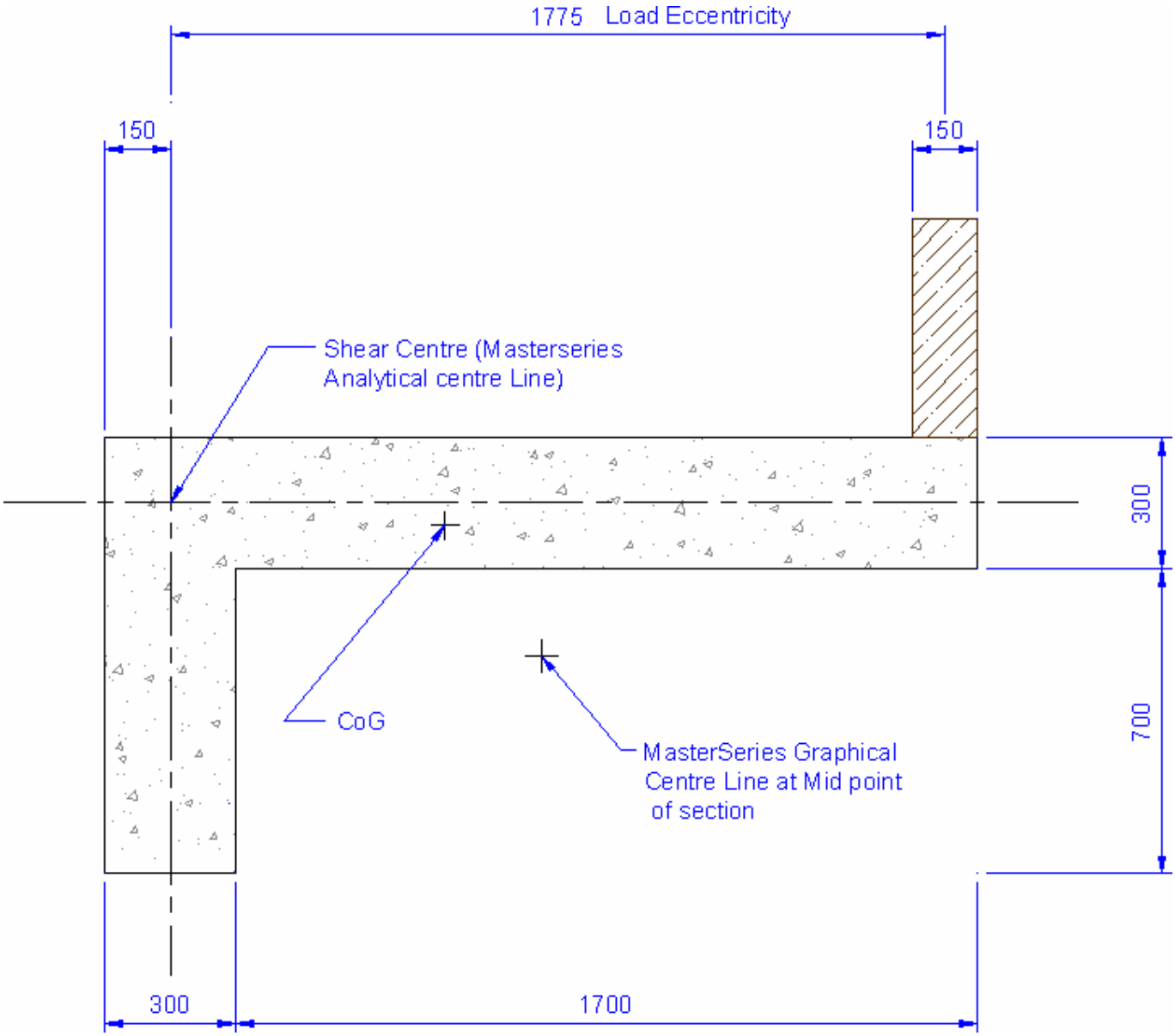
Above diagrams extracted from
SCI-P-057:Design of Members Subject to Combined Bending and Torsion

Thus in Single junction members such as **L**'s and **T**'s the shear centre is at the intersection of the middle of the flange and web.

Caution: It must be pointed out that the shear centres drawn above are based on the theory for "Thin-Walled" sections and thus are applicable to steel sections. For concrete sections that are reasonably proportioned this will still hold true, but the Engineer will need to use "Engineering Judgment".

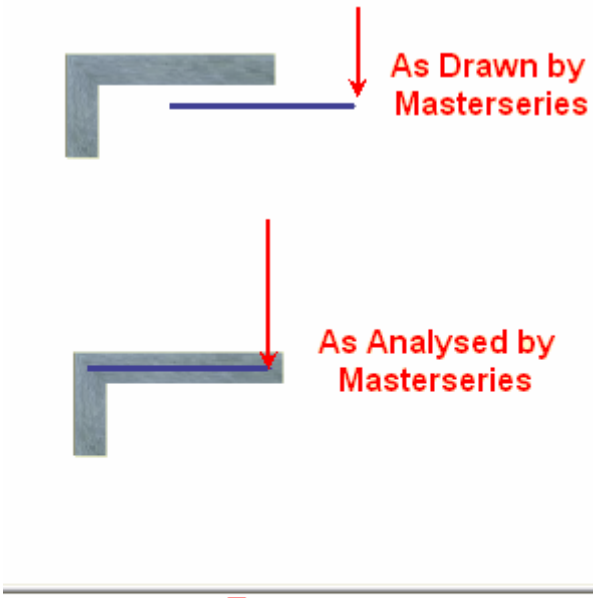
Thus to define an eccentric load on an asymmetrical section the you need to know the distance from the shear centre to the centre of your load.

Example:



Note: that the MasterSeries (currently) draws the section based on the section being centred on the wire frame line (which is incorrect) but does analyse the frame with the wire frame line representing the Shear Centre, thus no eccentric loads by default.

See opposite to define loads as described in the above example.




```
T Torq  ex +1.775 ey +0.000 ( m, m )
T UDLY -010.000             ( kN/m )
T Torq  ex +0.000 ey +0.000 ( m, m )
```

Regards

MasterSeries Team ☺