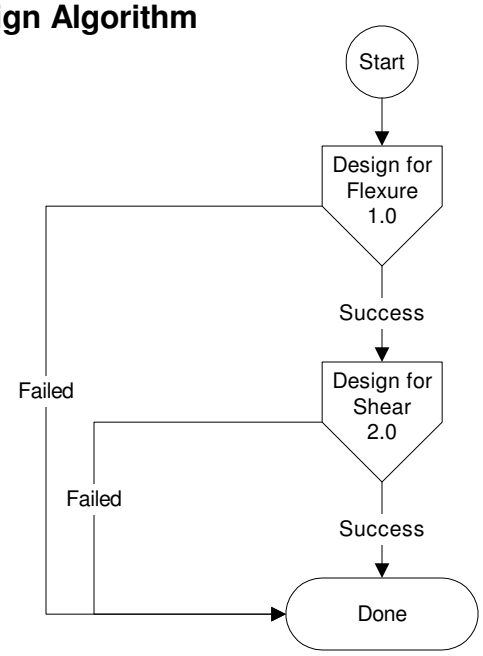
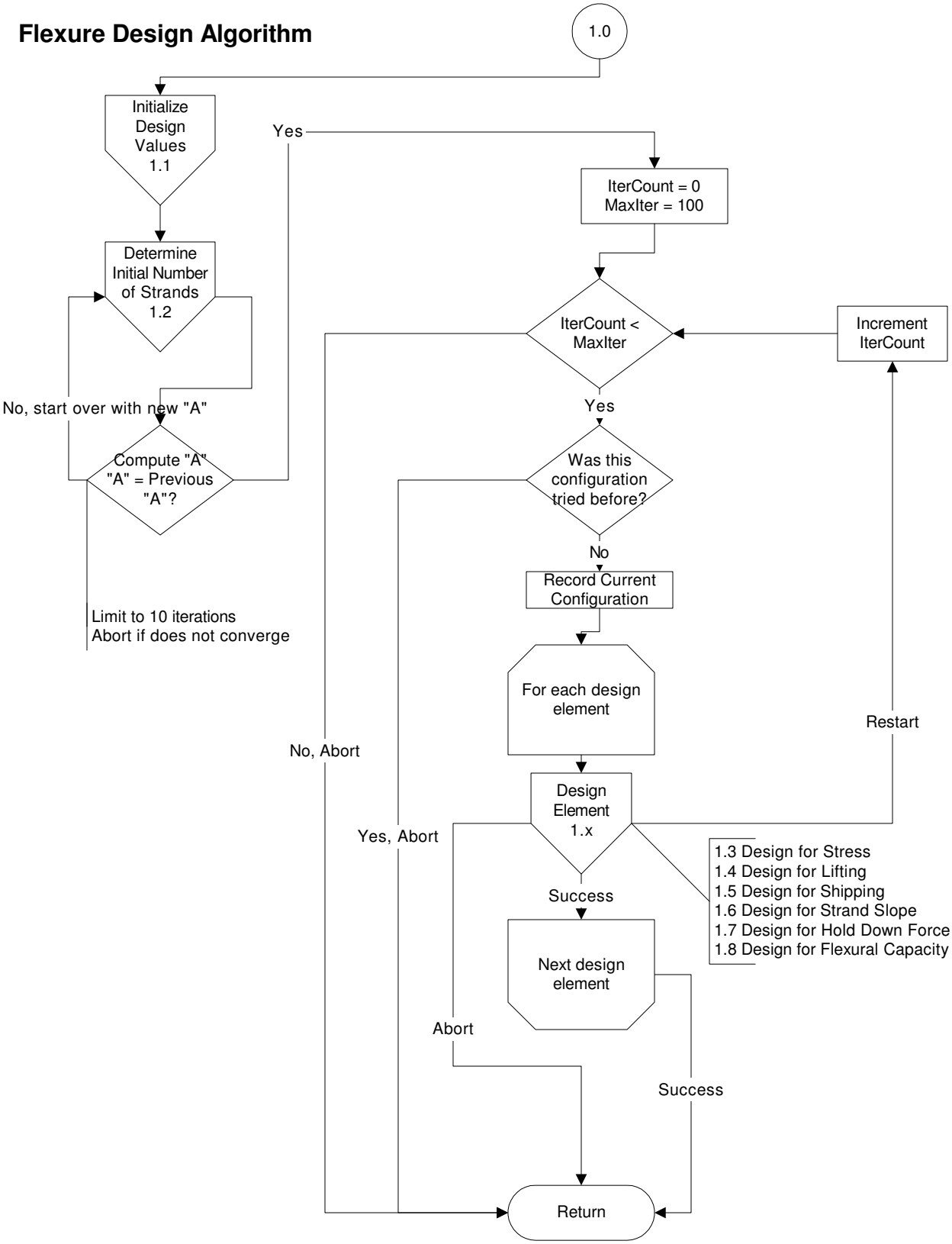
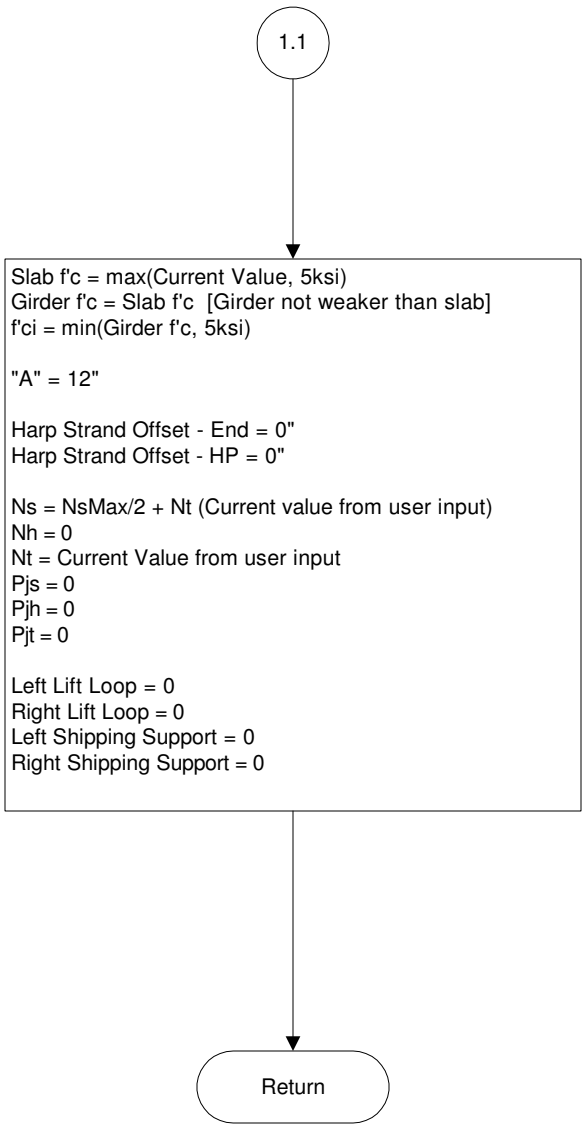
High Level Design Algorithm

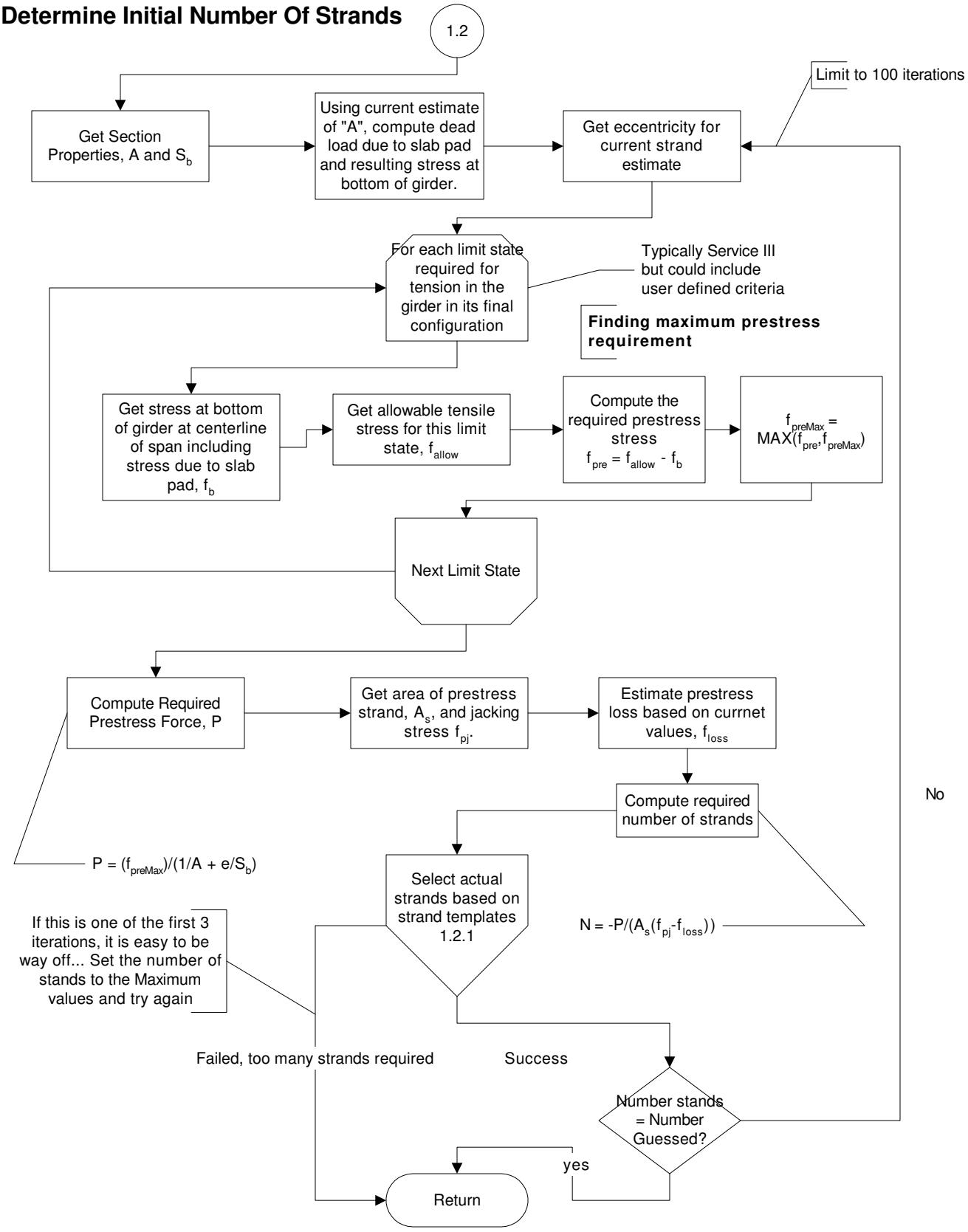


Flexure Design Algorithm

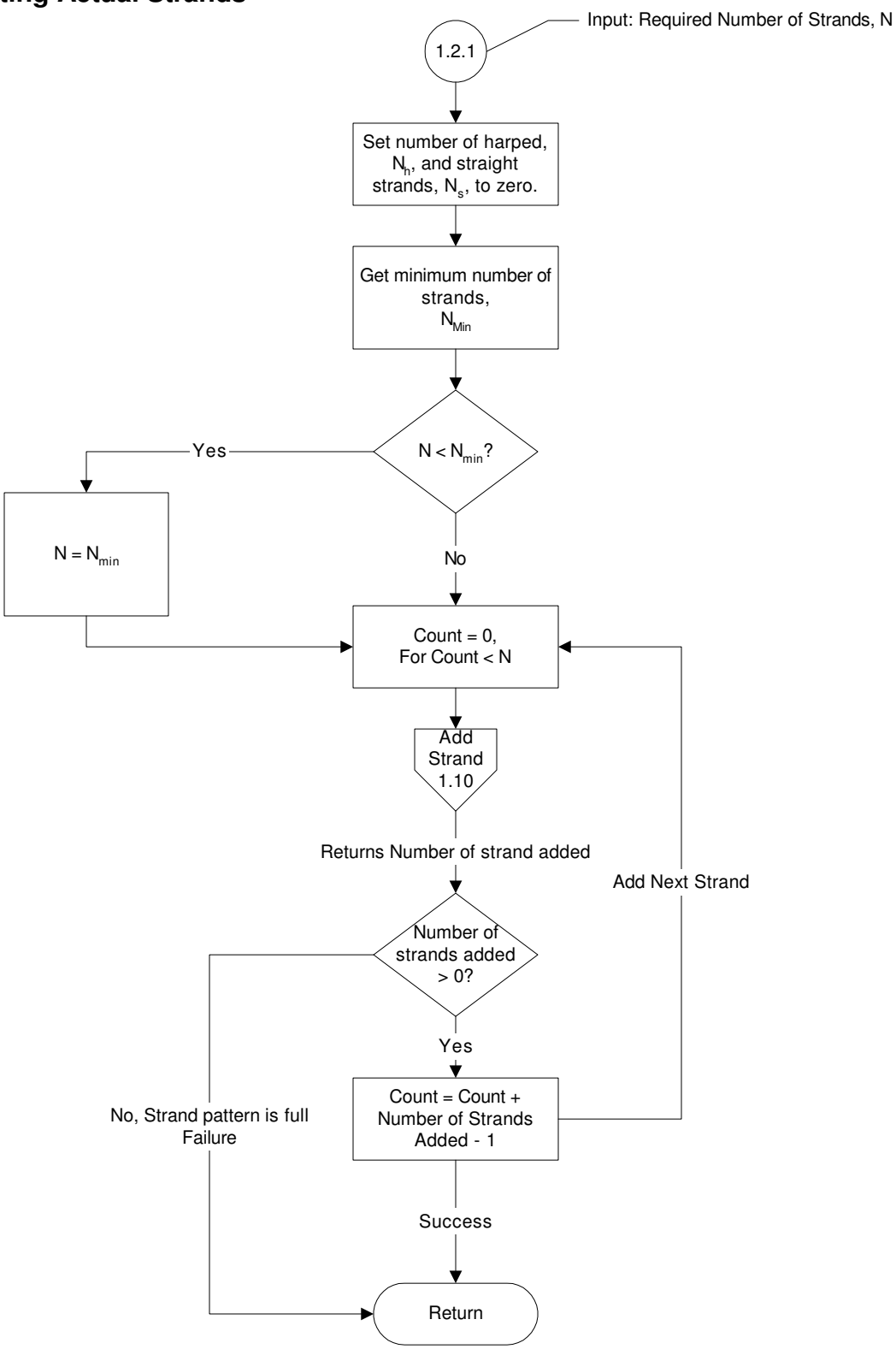



1.1
Slab f'c = max(Current Value, 5ksi)
Girder f'c = Slab f'c [Girder not weaker than slab]
f'ci = min(Girder f'c, 5ksi)
"A" = 12"
Harp Strand Offset - End = 0"
Harp Strand Offset - HP = 0"
Ns = NsMax/2 + Nt (Current value from user input)
Nh = 0
Nt = Current Value from user input
Pjs = 0
Pjh = 0
Pjt = 0
Left Lift Loop = 0
Right Lift Loop = 0
Left Shipping Support = 0
Right Shipping Support = 0
Return

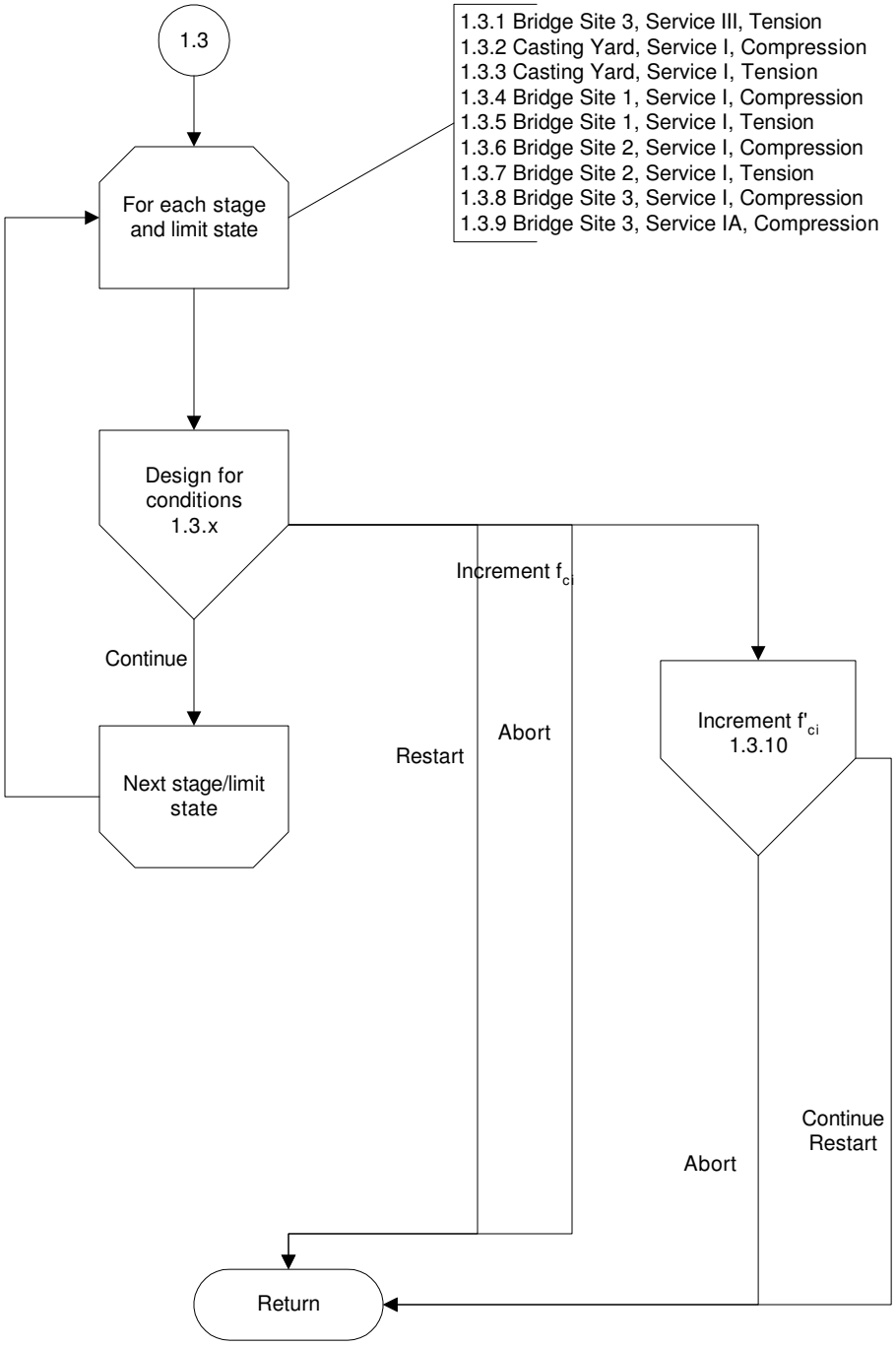
Determine Initial Number Of Strands

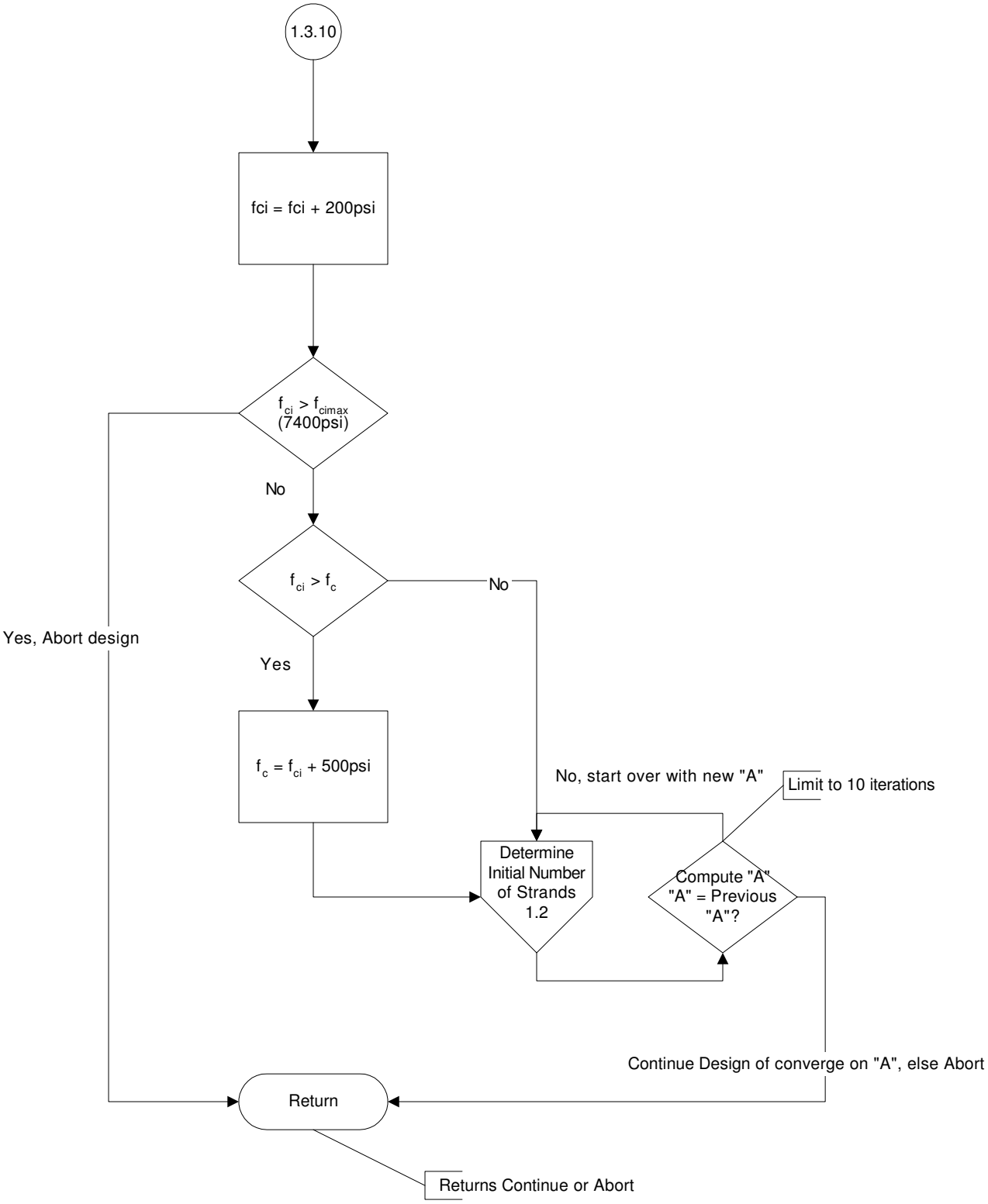


Selecting Actual Strands

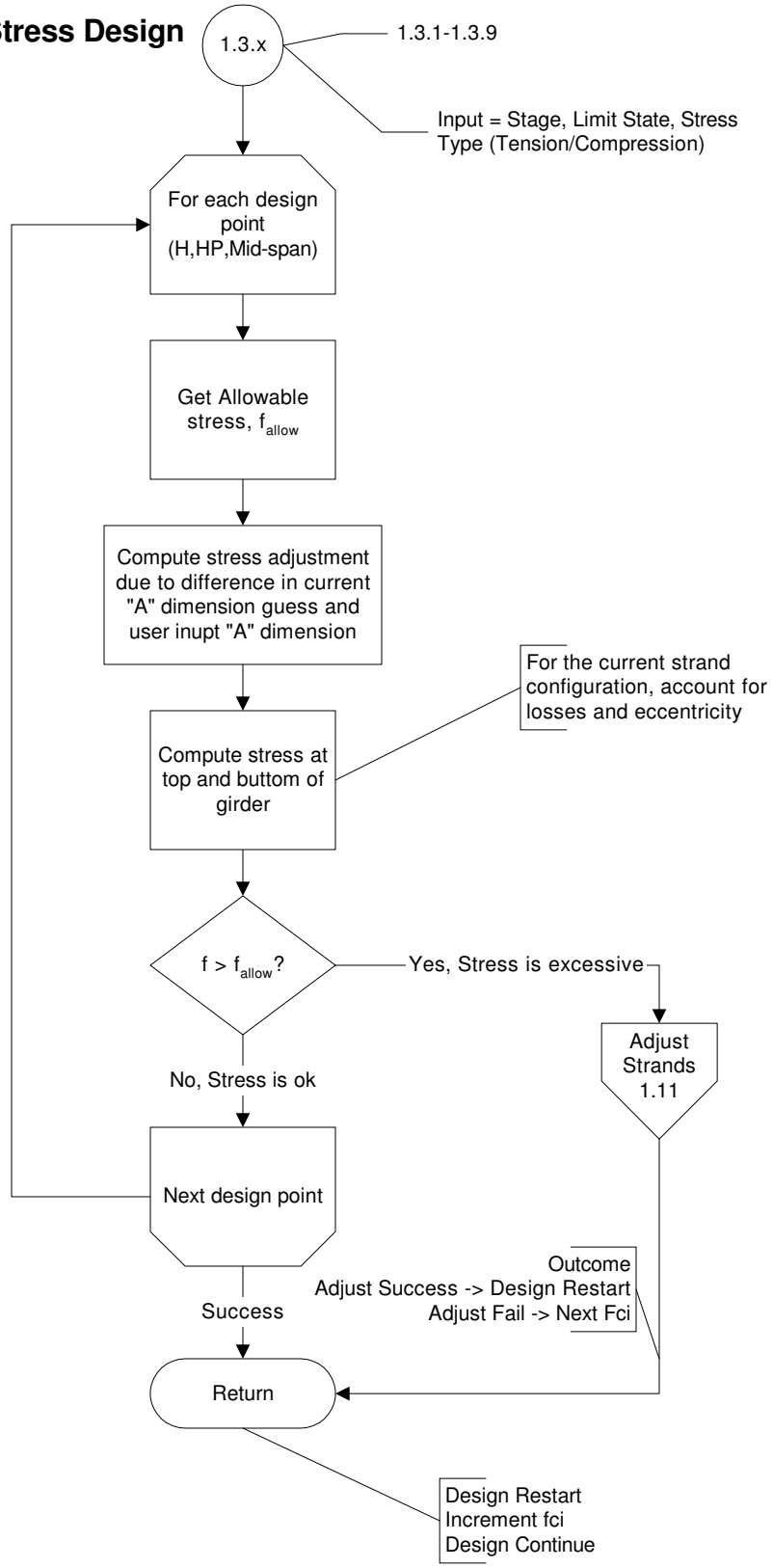


Design for Stress

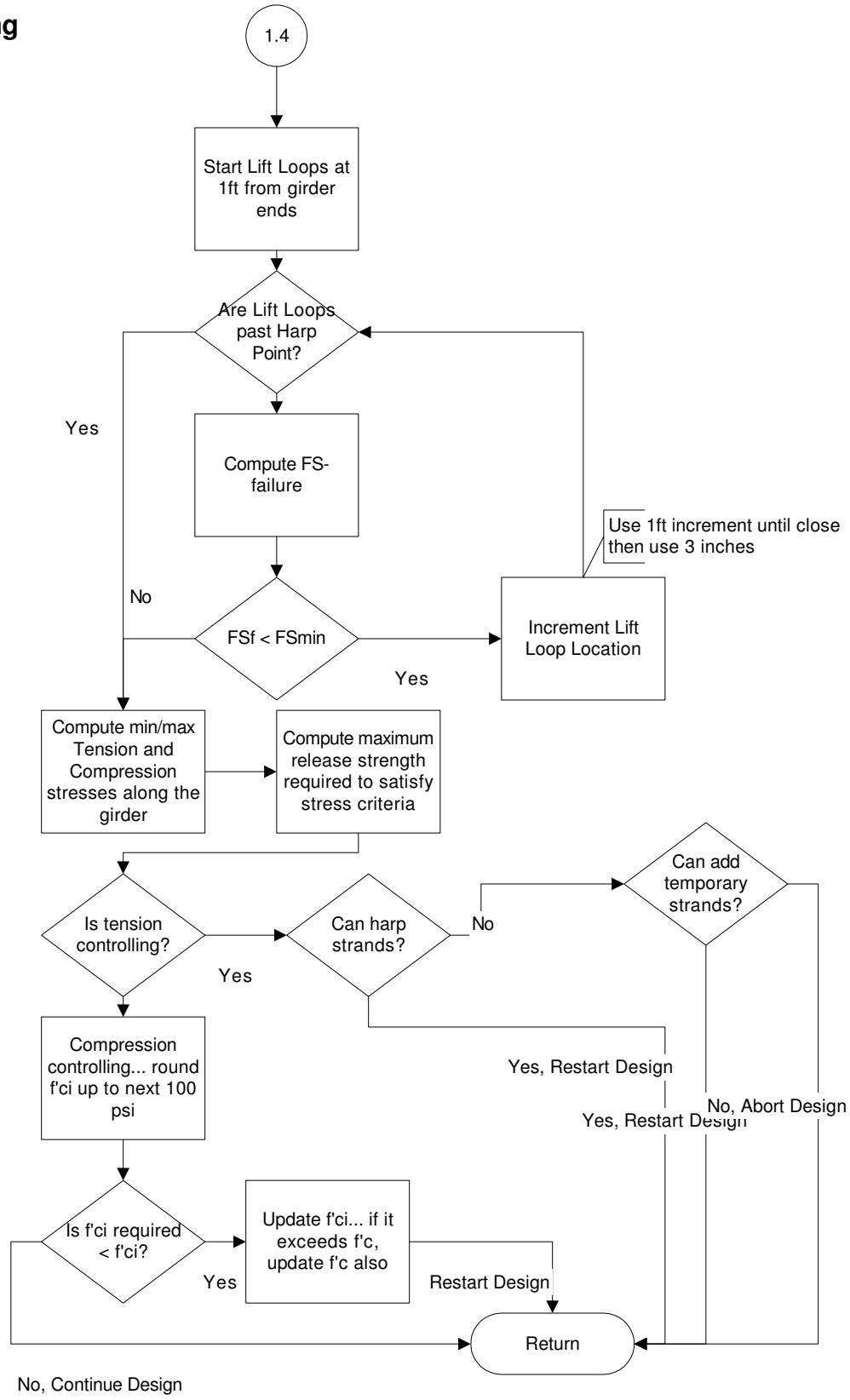



1.3.10
fci = fci + 200psi
$f_{ci} > f_{cimax}$ (7400psi)
No
$f_{ci} > f_c$
No
Yes, Abort design
Yes
$f_c = f_{ci} + 500psi$
No, start over with new "A"
Limit to 10 iterations
Determine Initial Number of Strands 1.2
Compute "A" "A" = Previous "A"?
Continue Design of converge on "A", else Abort
Return
Returns Continue or Abort

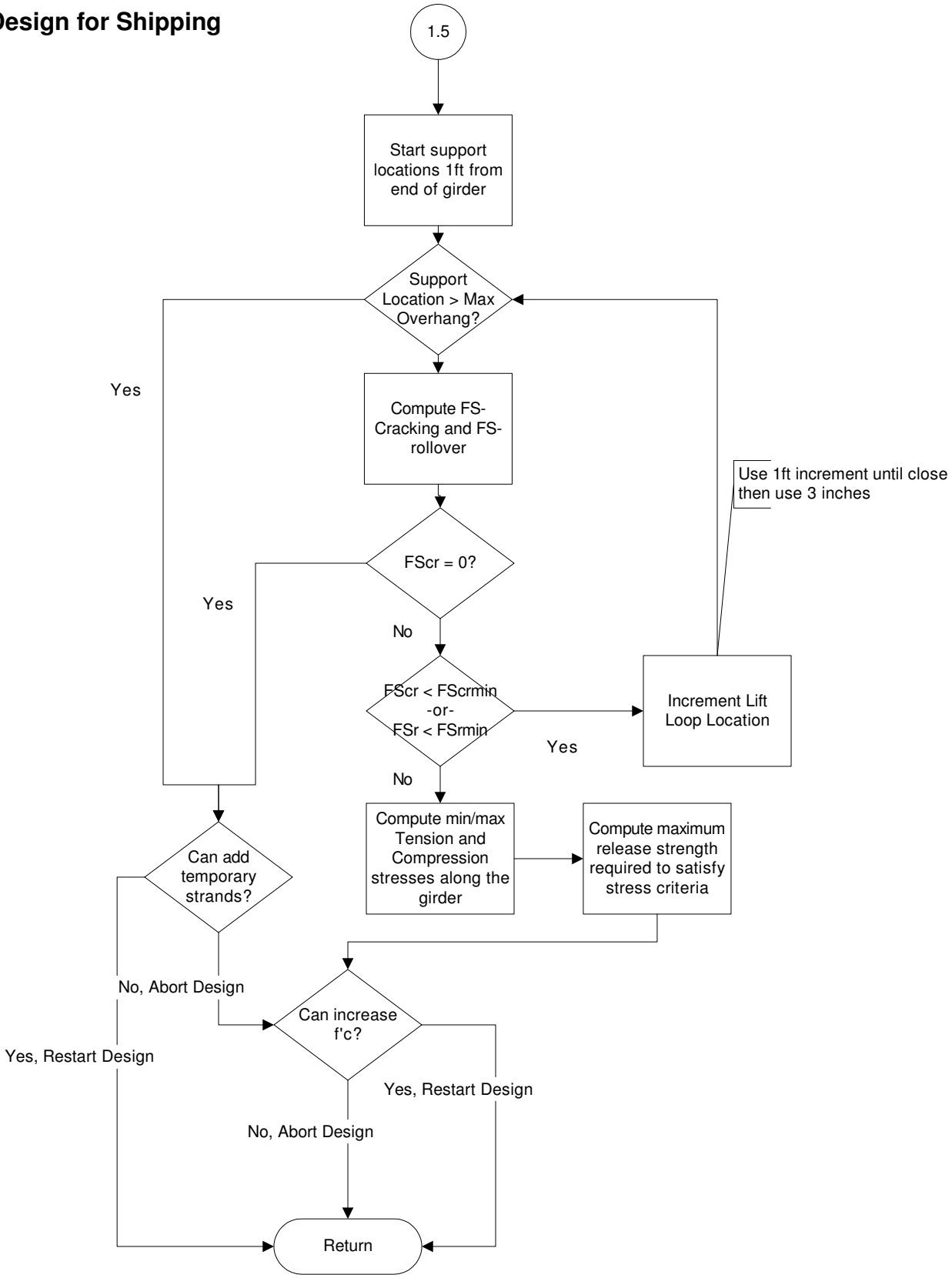
General Procedure for Stress Design



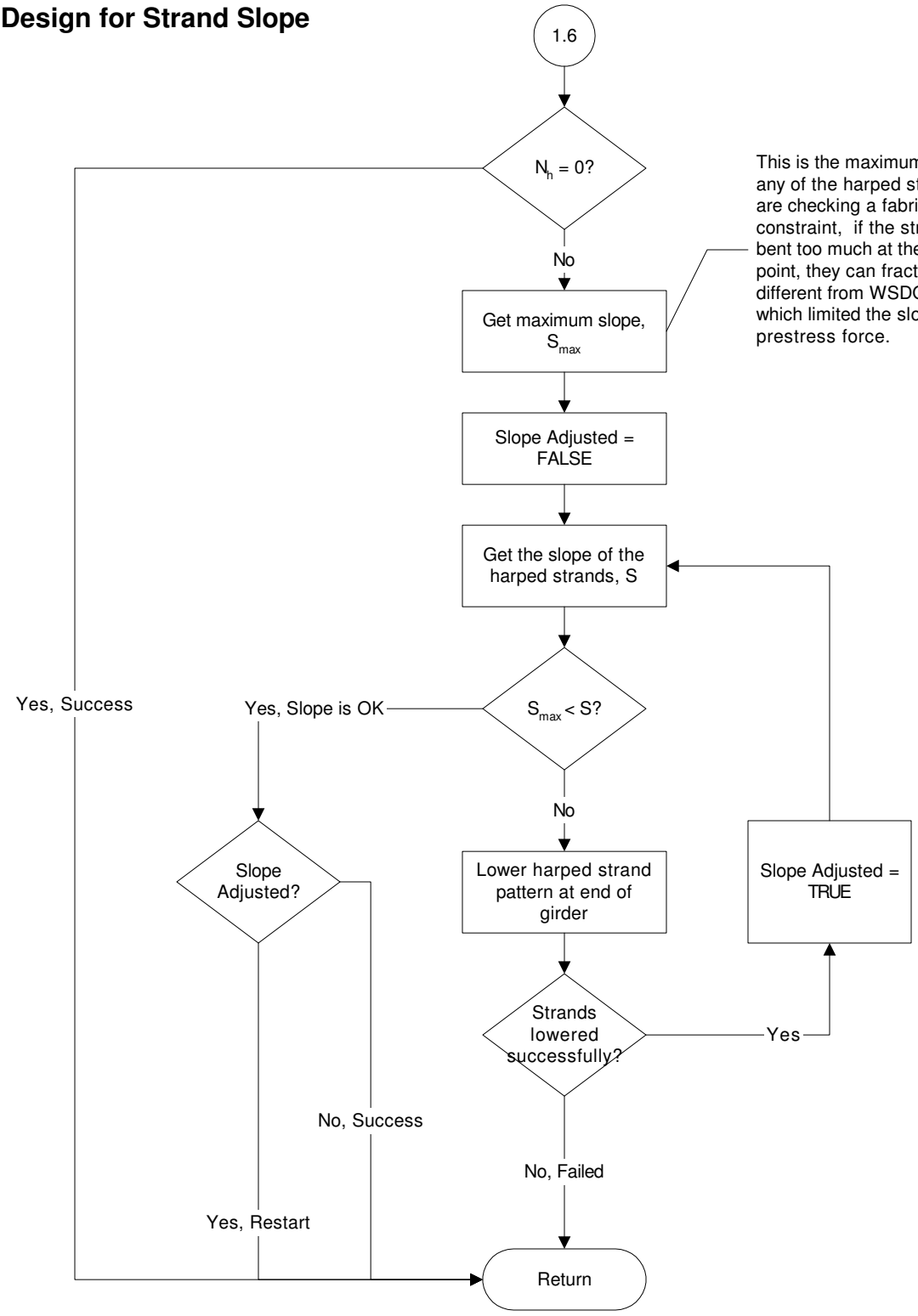
Design for Lifting



Design for Shipping

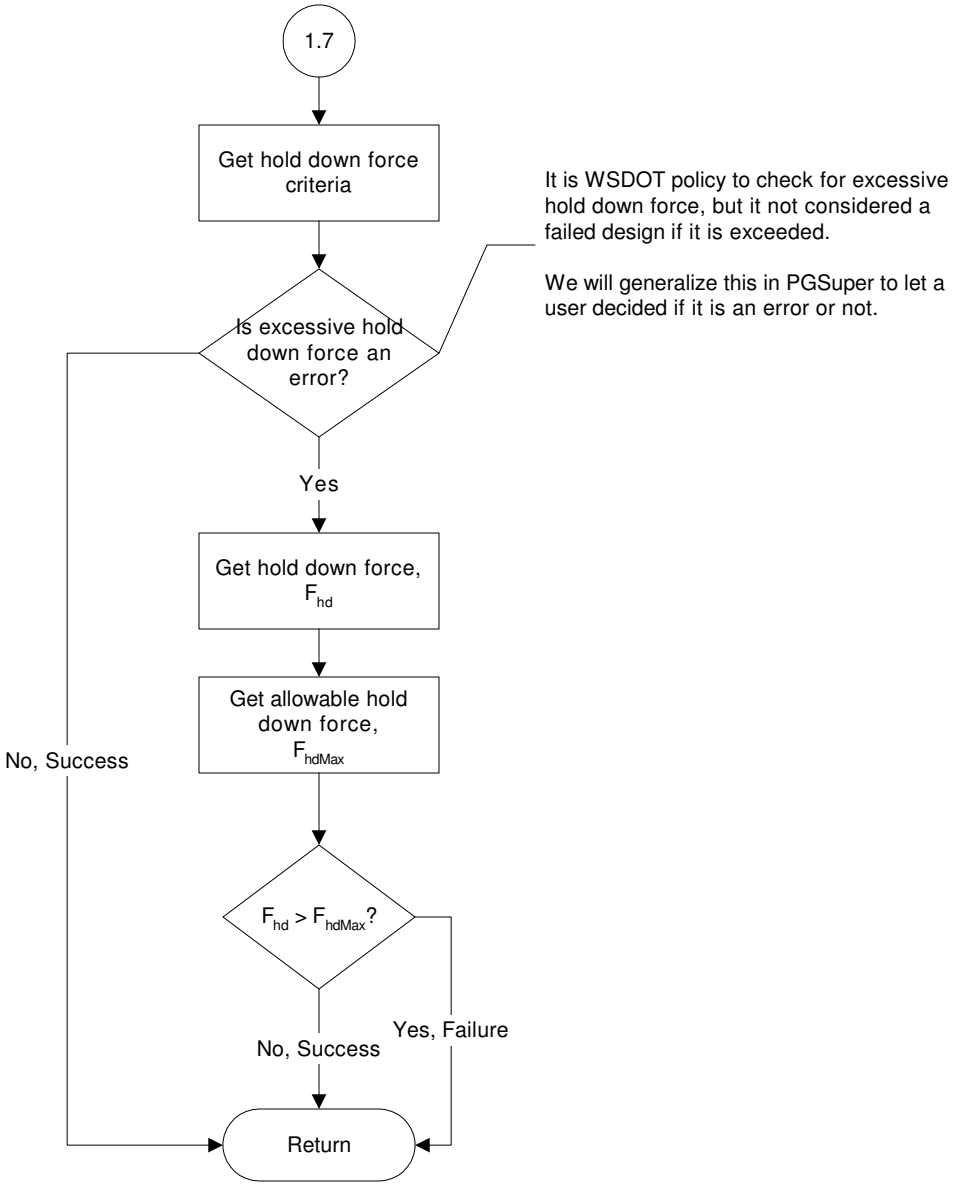


Design for Strand Slope

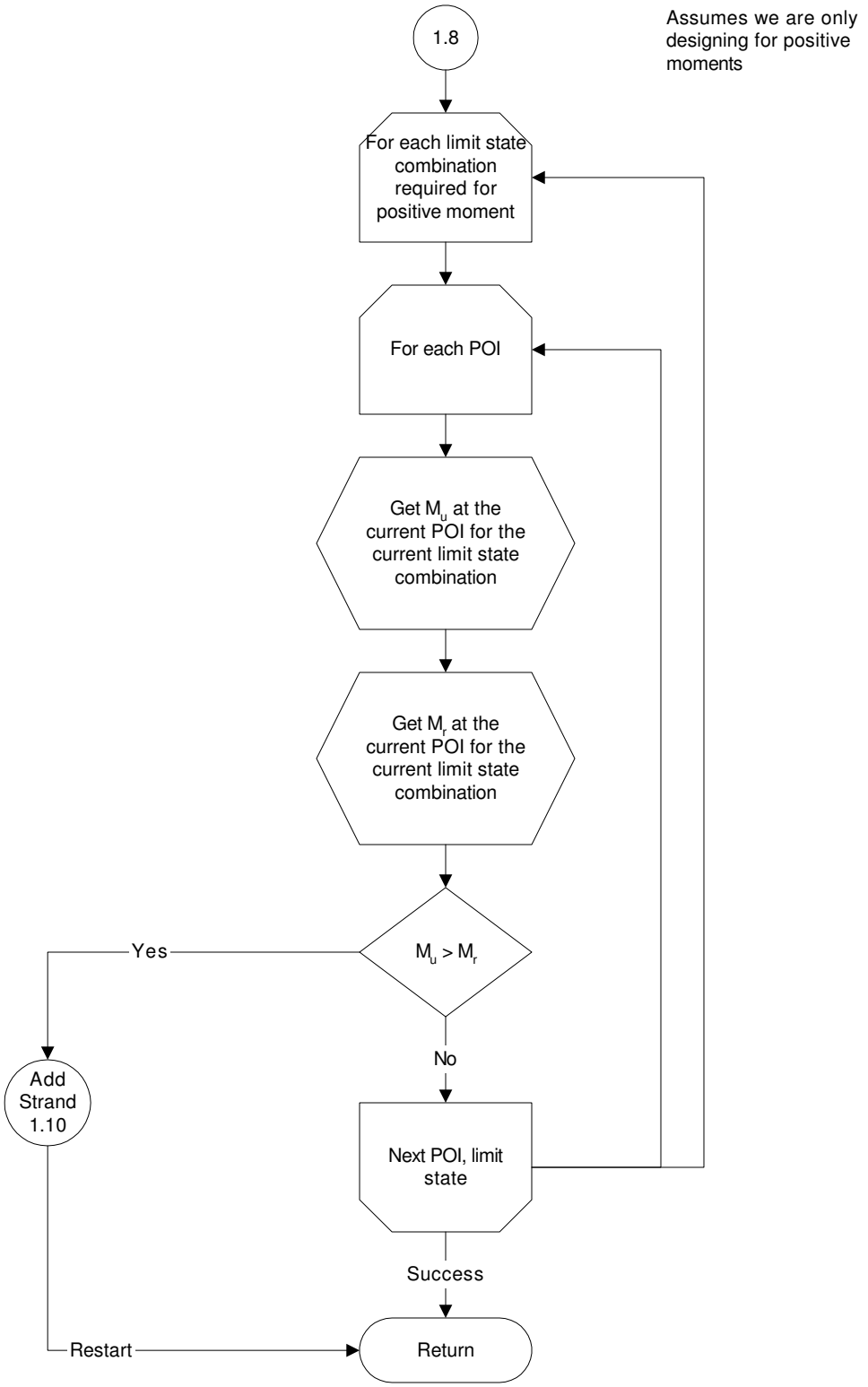


This algorithm assumes the strand slope is the same on both ends of the girder. For PGSuper, this is true. For a more general case, the slopes at each end of the girder need to be checked and adjusted.

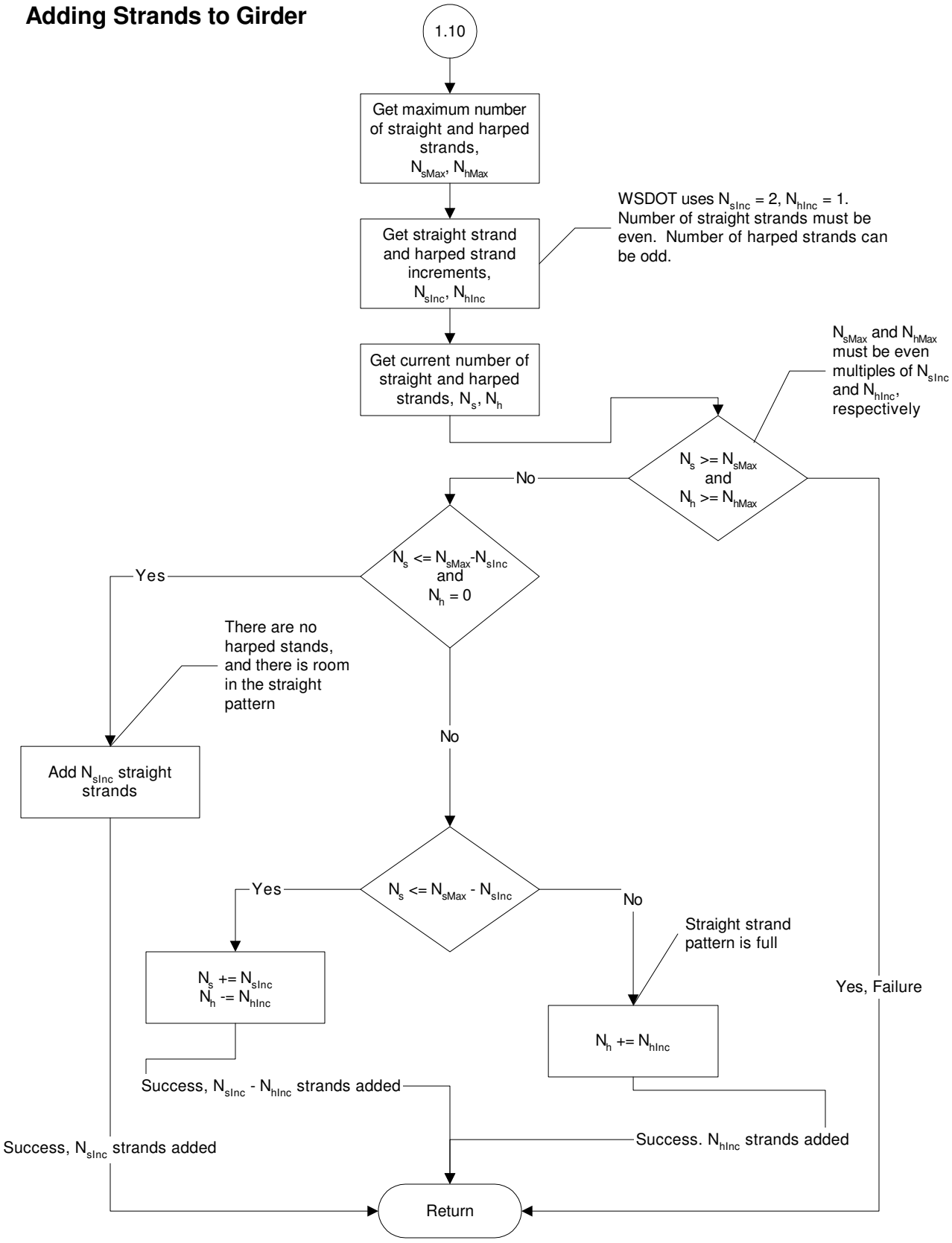
Check Hold Down Force



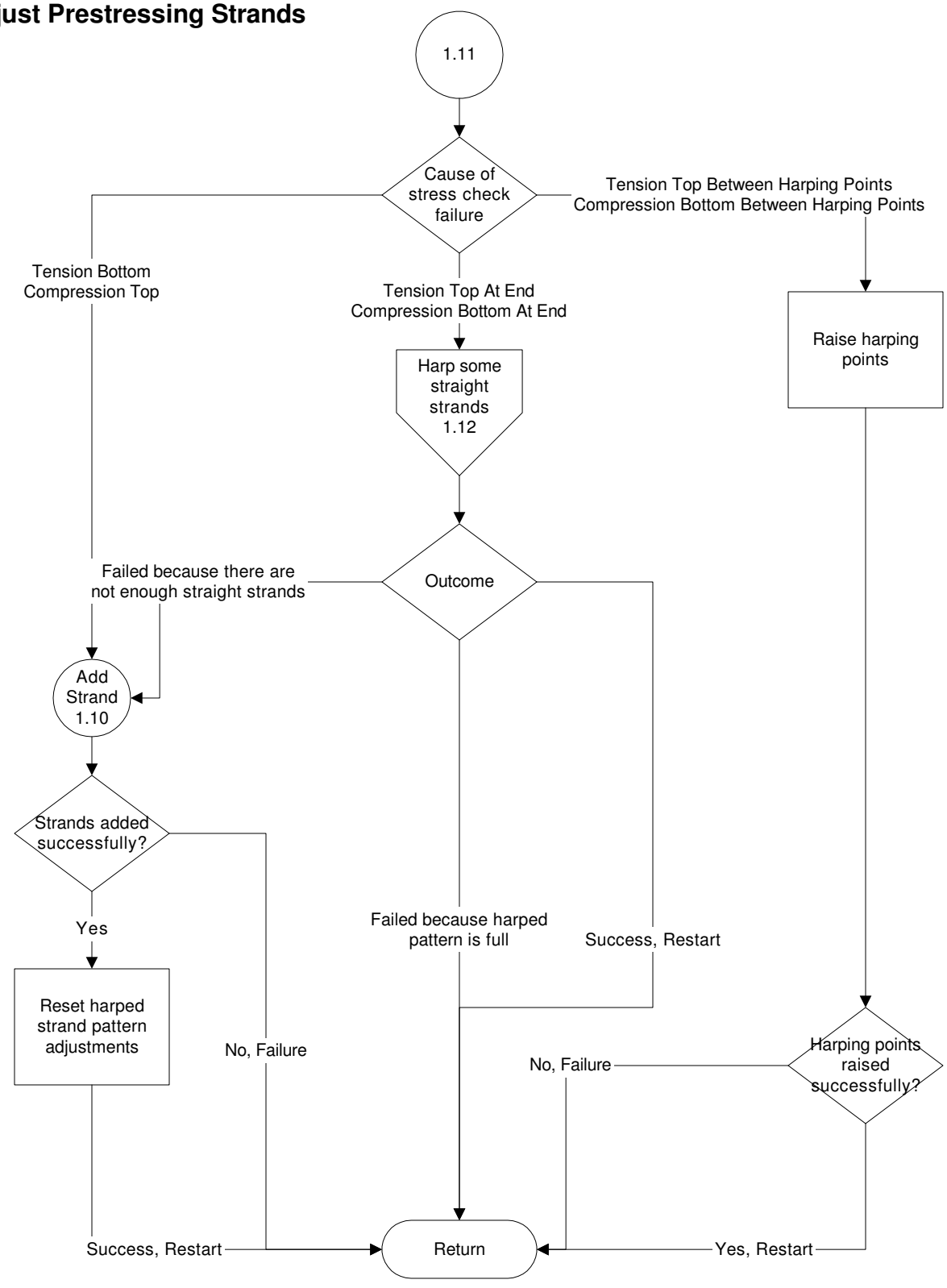
Design for Flexural Capacity



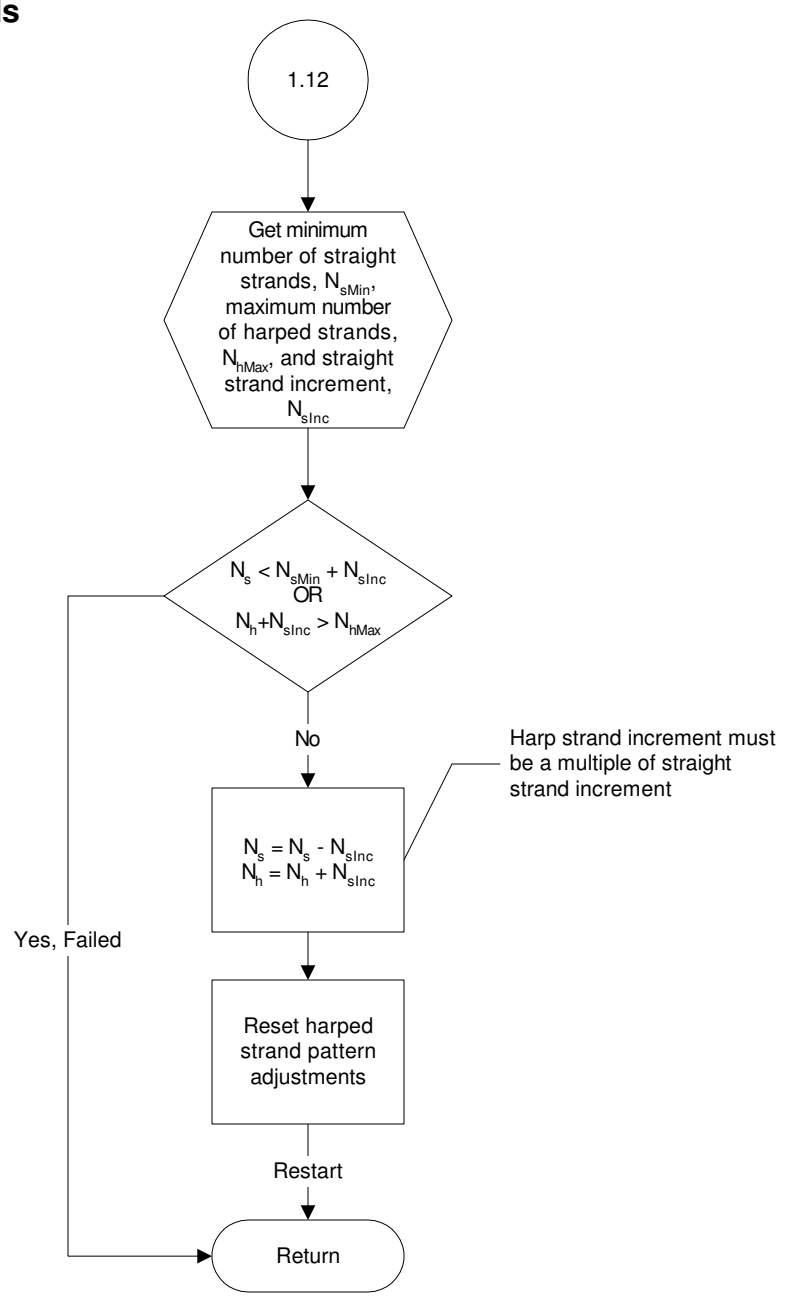
Adding Strands to Girder



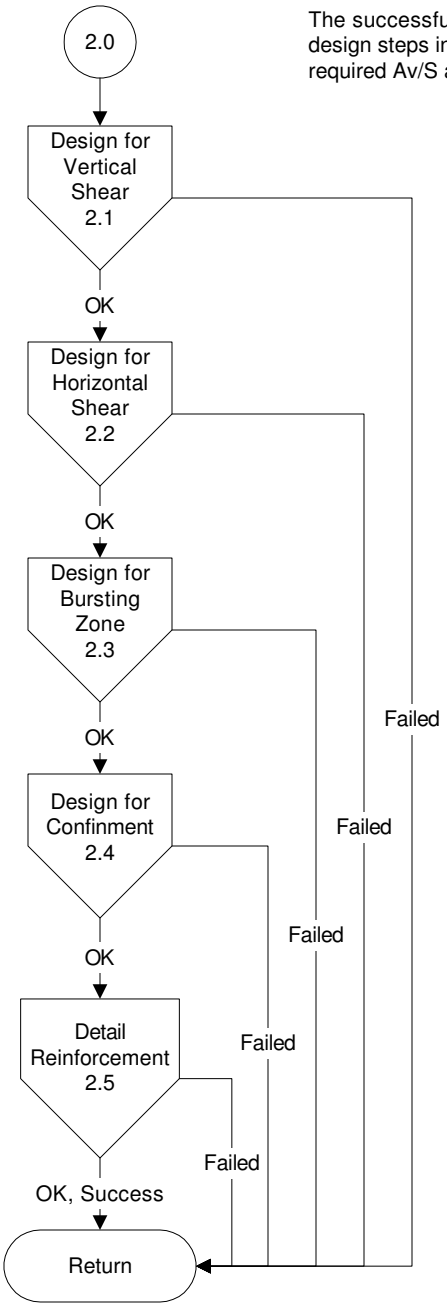
Adjust Prestressing Strands



Harp Straight Strands

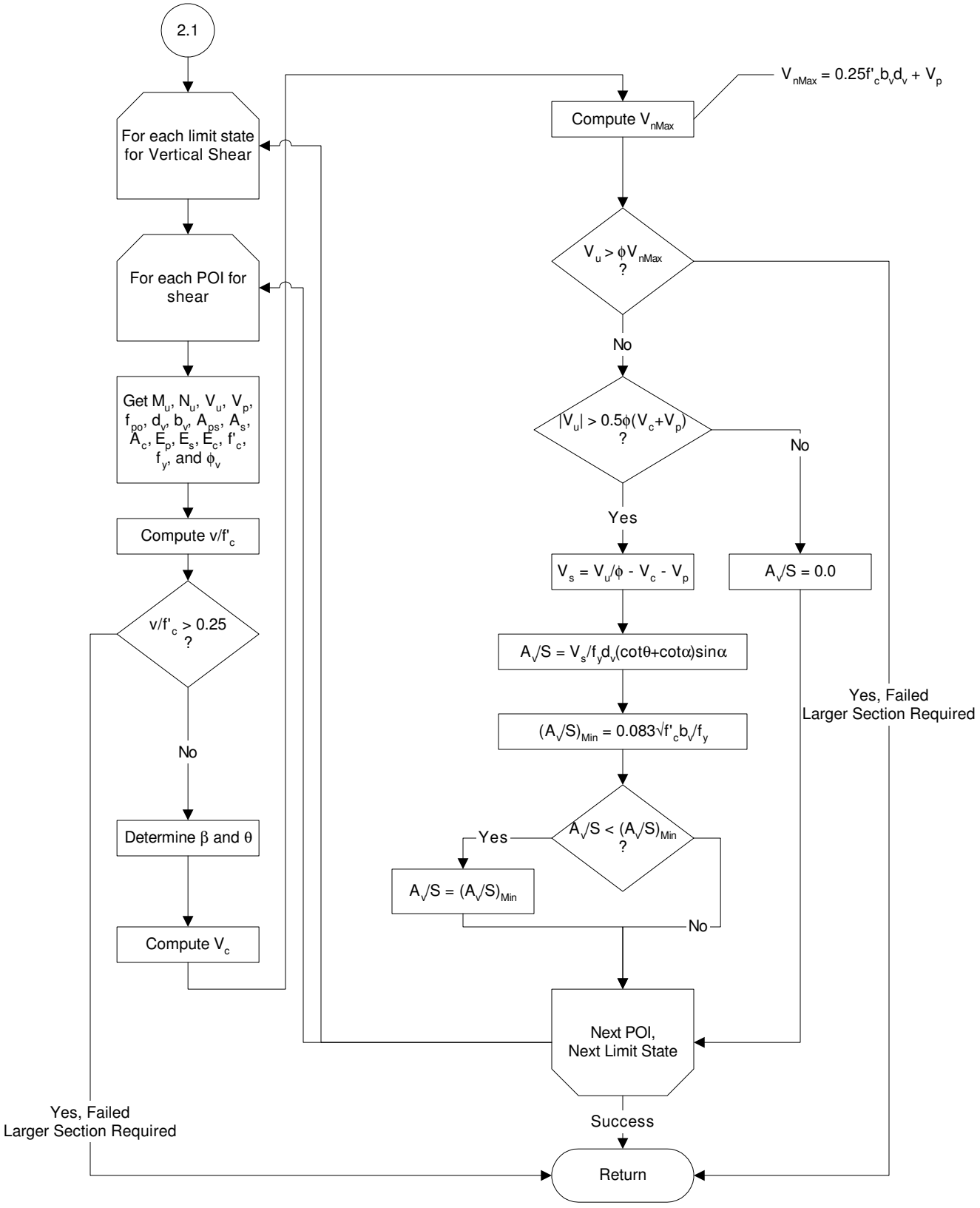


Design for Shear

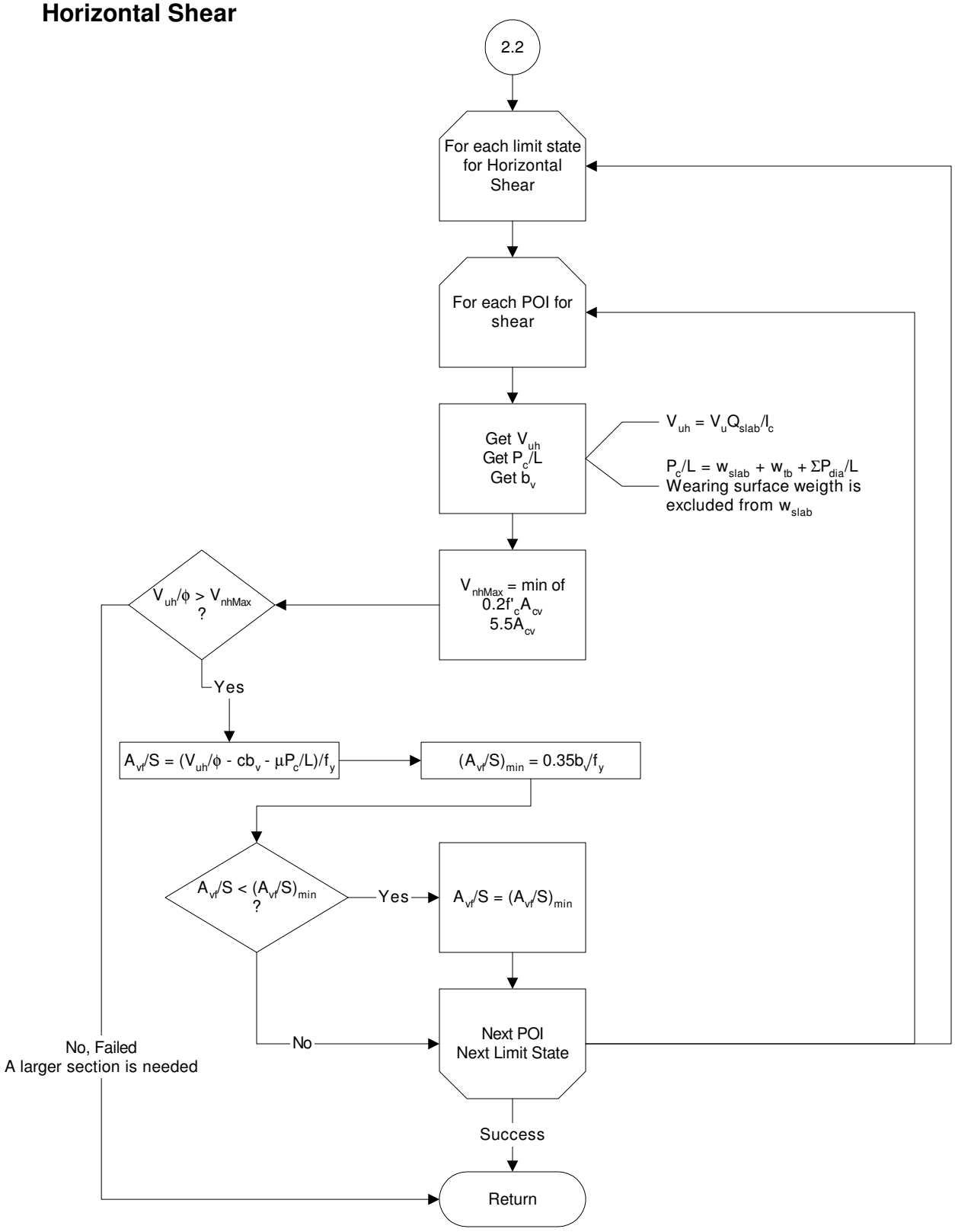


The successful outcome of each of the design steps in this algorithm produces the required Av/S at each POI.

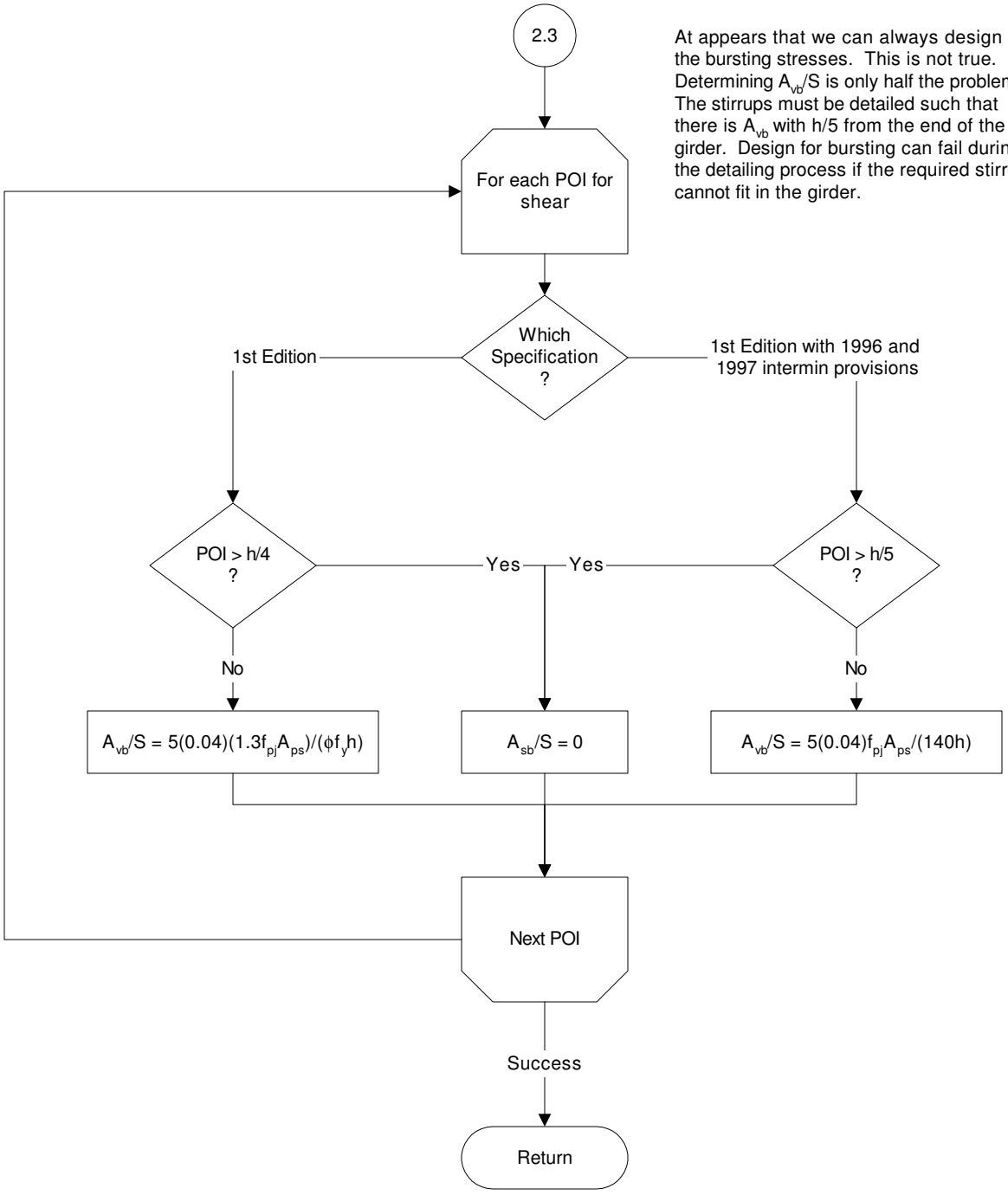
Design for Vertical Shear



Horizontal Shear

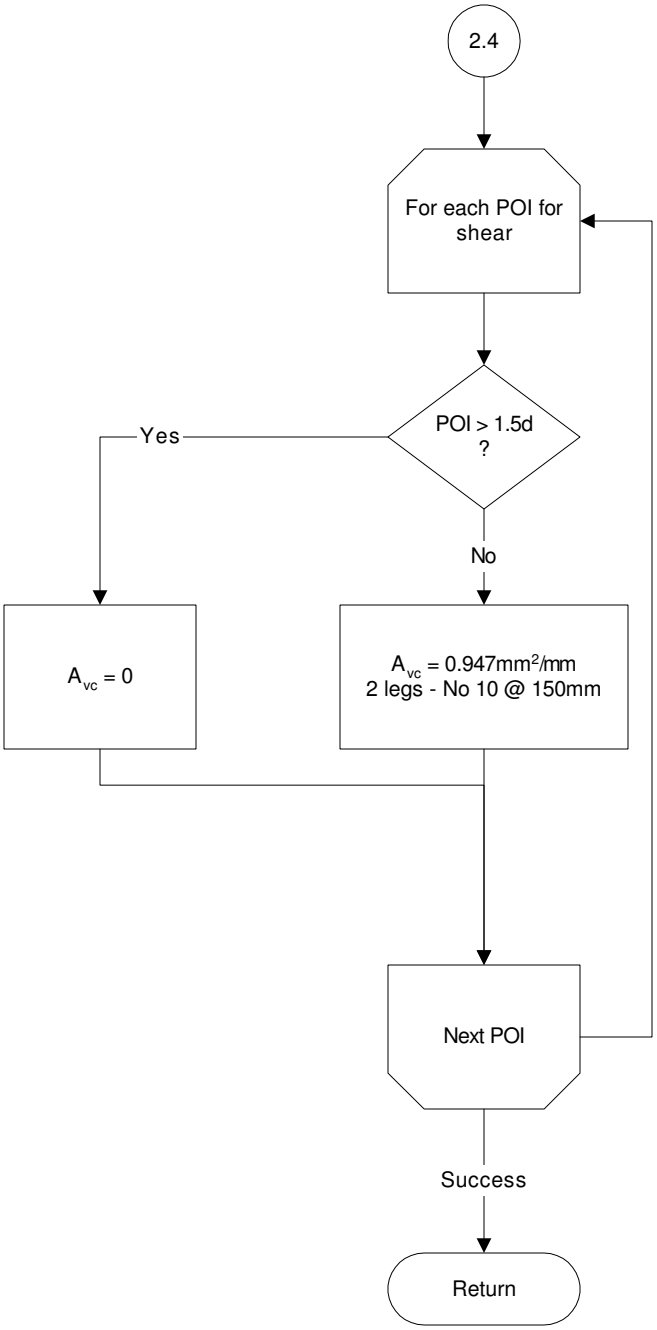


Design for Bursting Zone

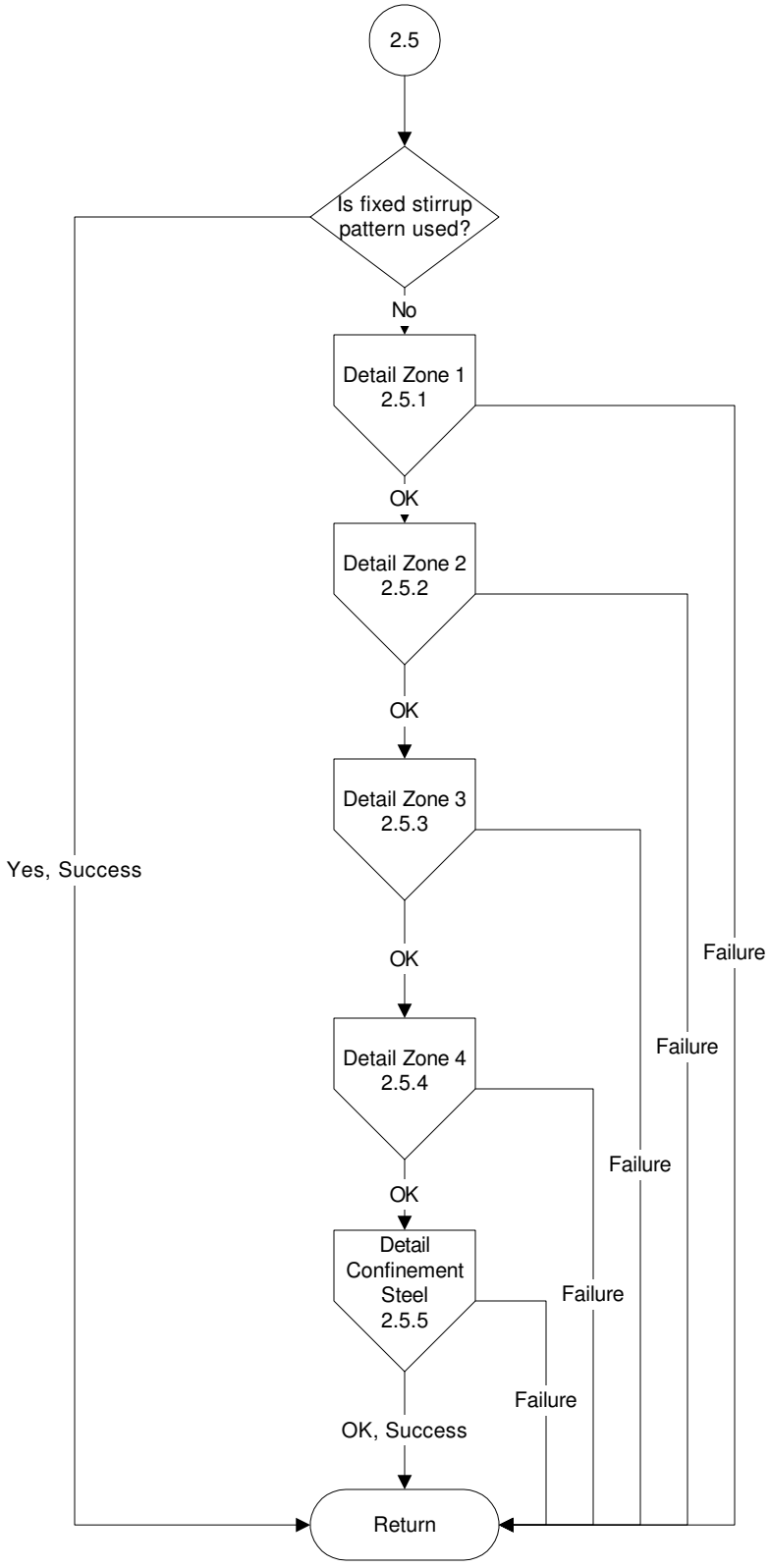


At appears that we can always design for the bursting stresses. This is not true. Determining A_{vb}/S is only half the problem. The stirrups must be detailed such that there is A_{vb} with h/5 from the end of the girder. Design for bursting can fail during the detailing process if the required stirrups cannot fit in the girder.

Design for Confinement

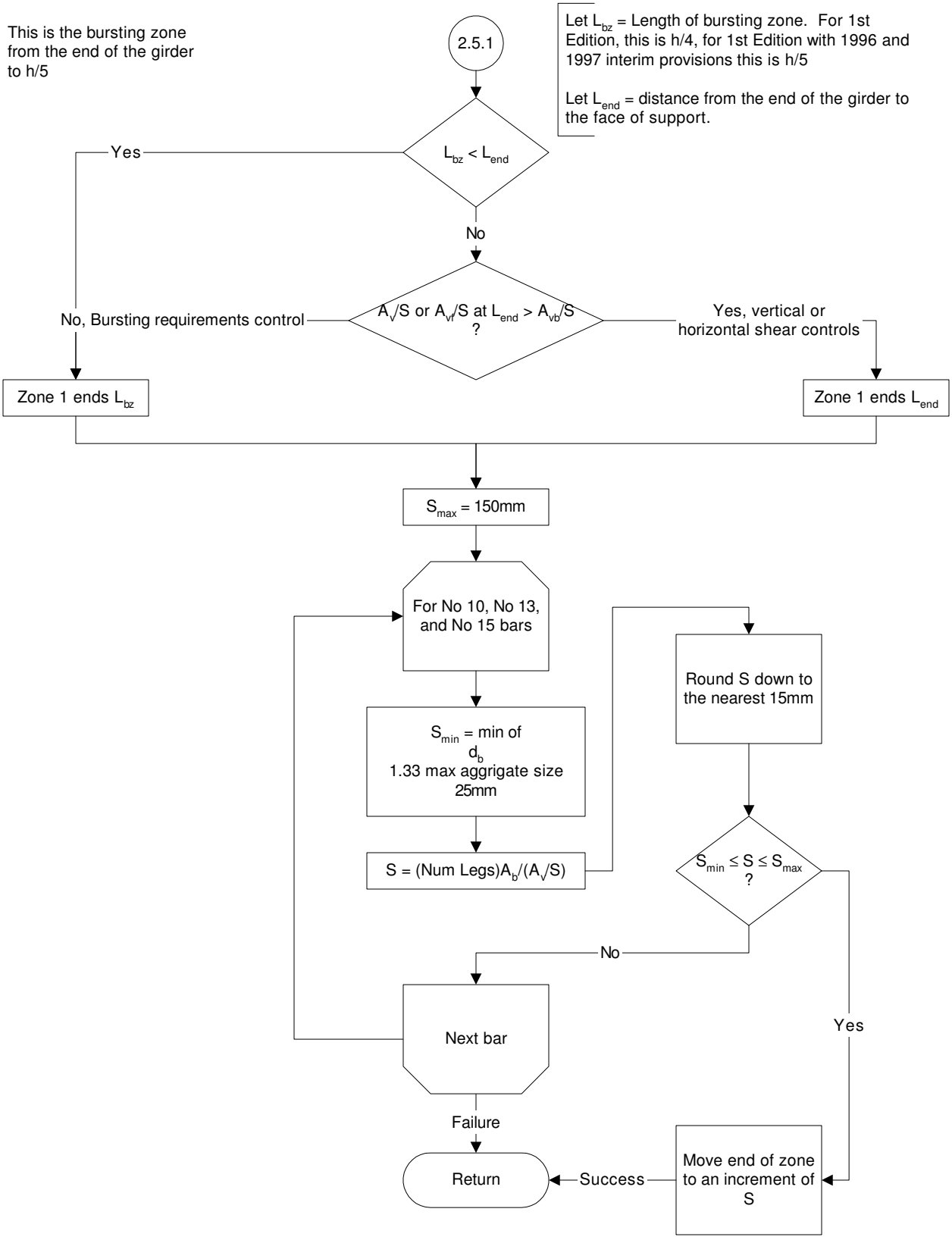


Detail Lateral Reinforcement



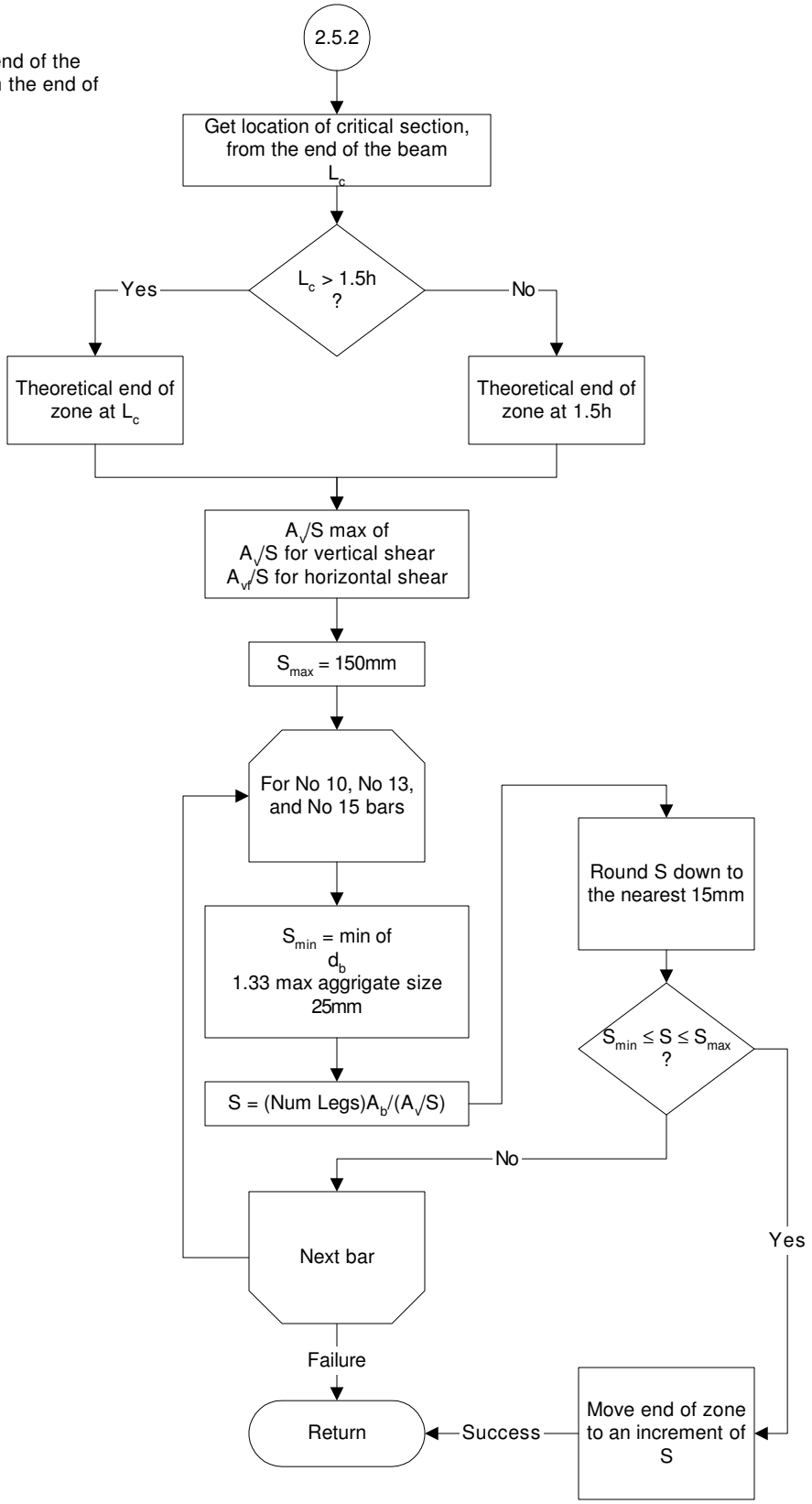
Detail Zone 1

This is the bursting zone from the end of the girder to h/5

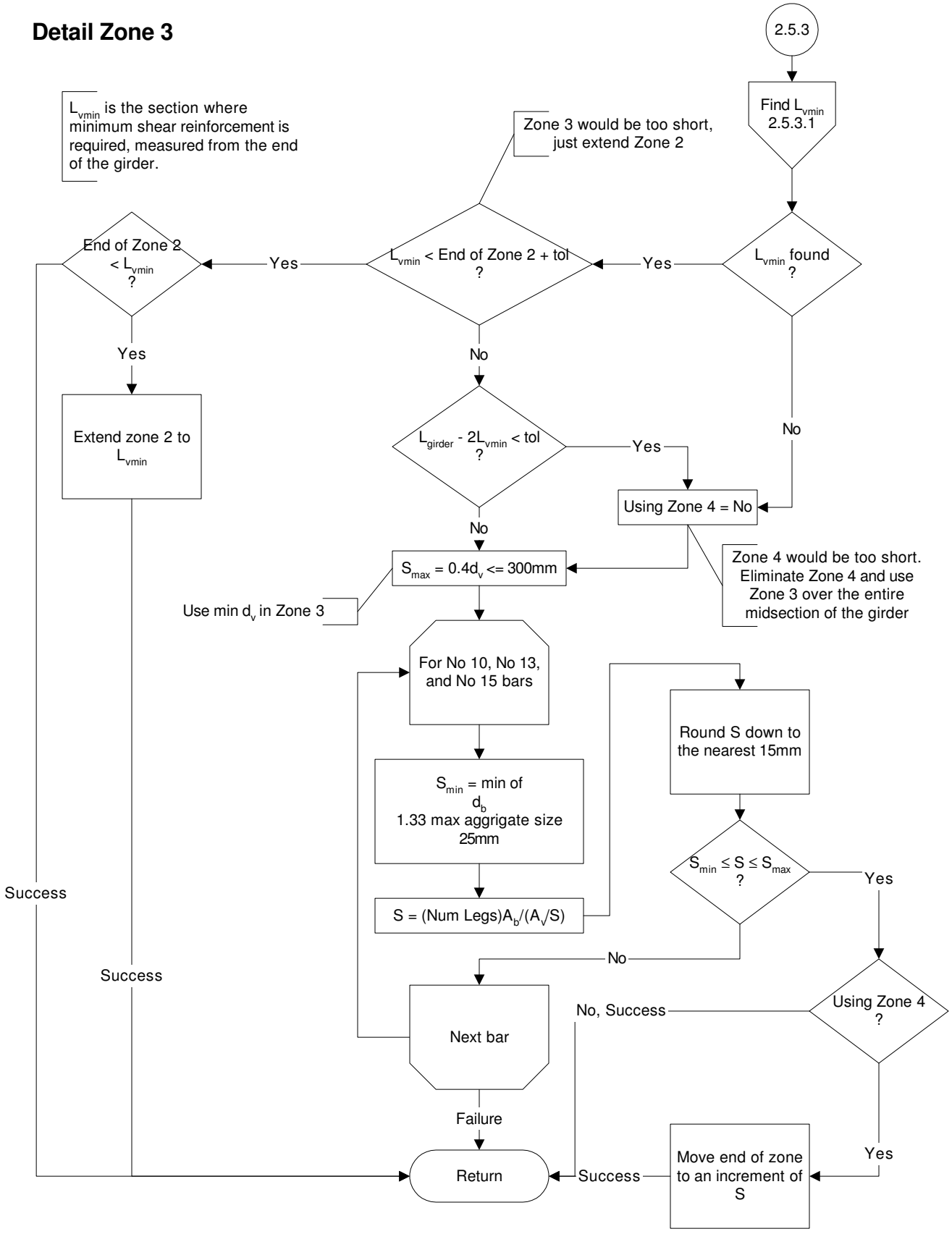


Detail Zone 2

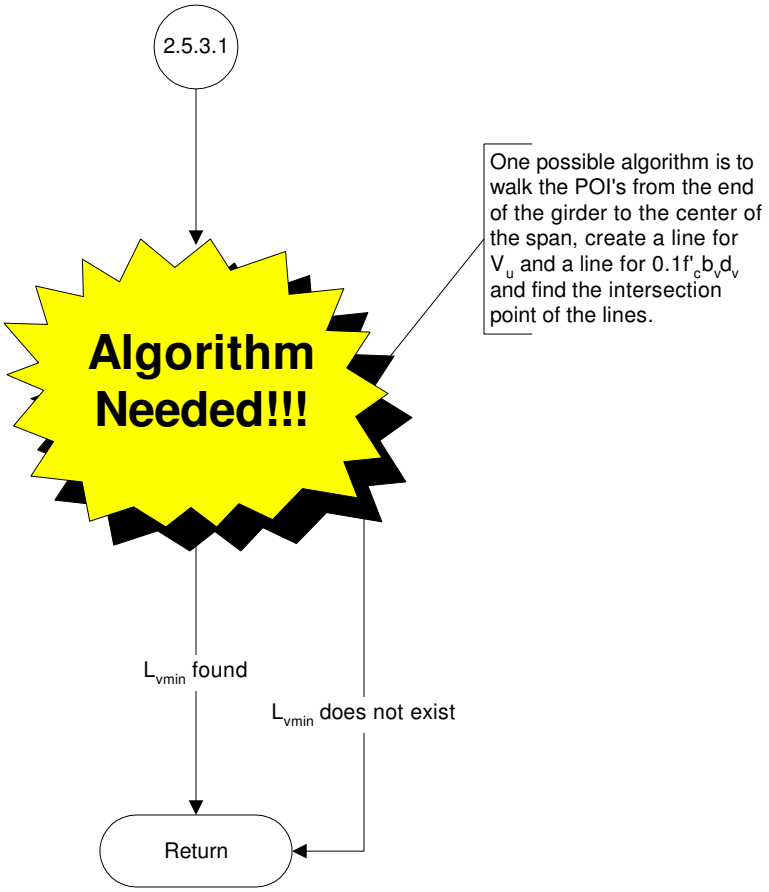
This zone goes from the end of the bursting zone to 1.5h from the end of the girder



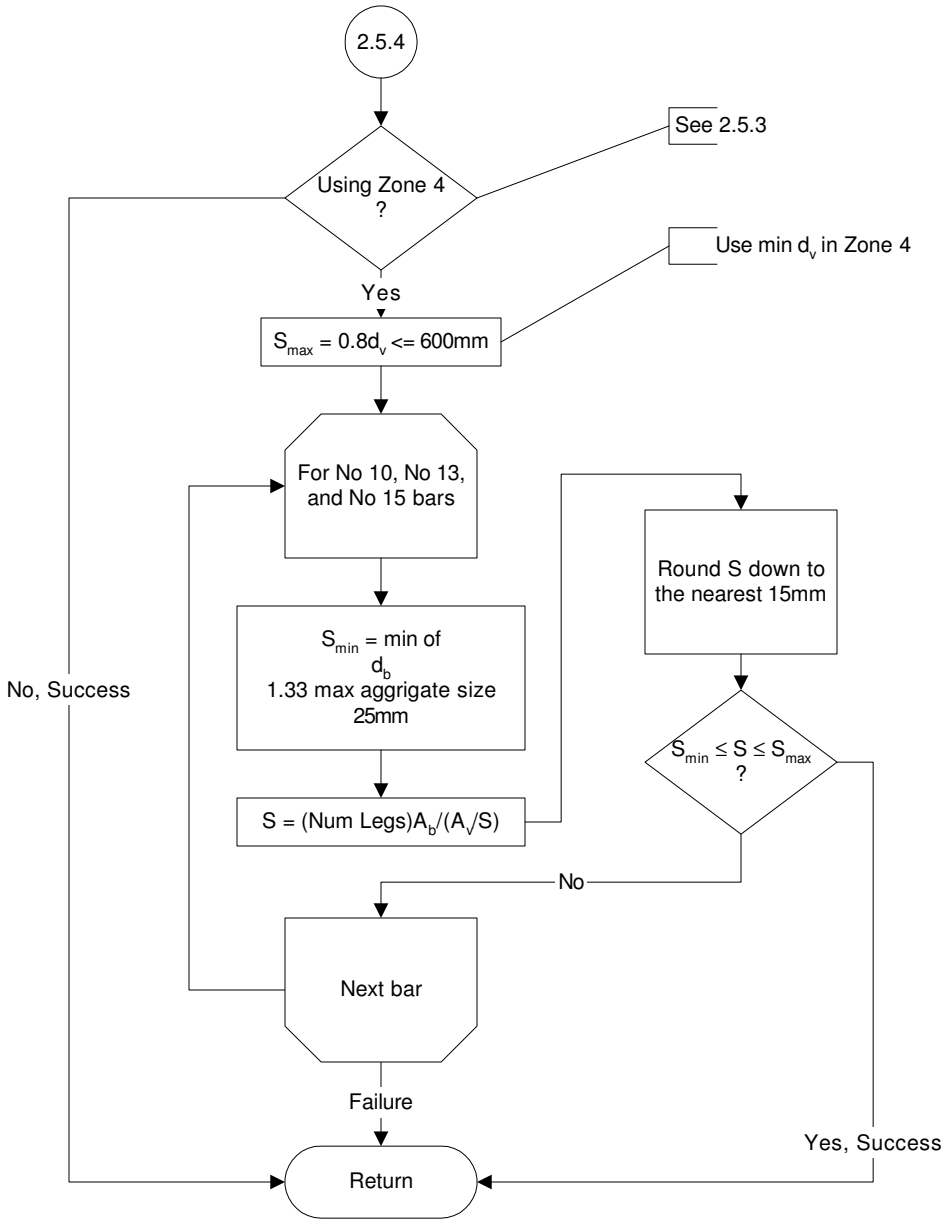
Detail Zone 3



Find L_{vmin}


2.5.3.1
Algorithm Needed!!!
One possible algorithm is to walk the POI's from the end of the girder to the center of the span, create a line for V_u and a line for $0.1f'_c b_v d_v$ and find the intersection point of the lines.
L_{vmin} found
L_{vmin} does not exist
Return

Detail Zone 4



Detail Confinement Steel