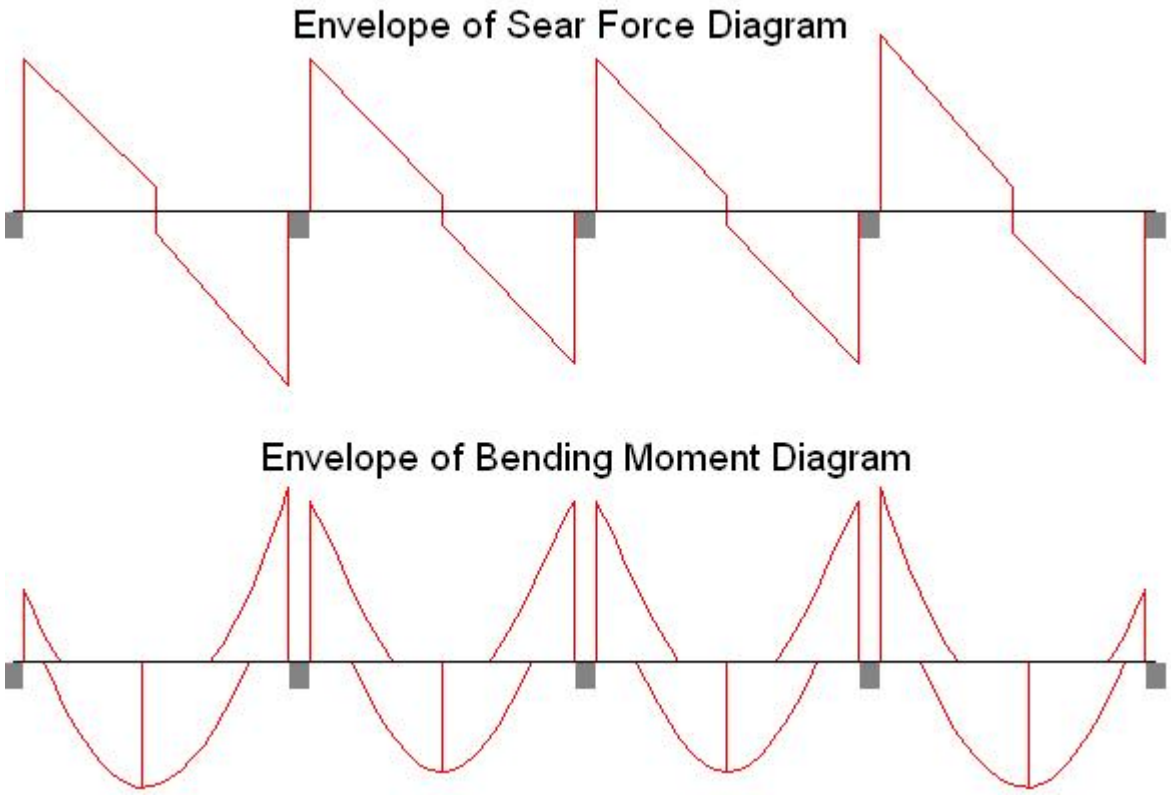
ACI / SBC coefficient method of analysis

The ACI / SBC approximate method (also called coefficient method) is used for the analysis of continuous beams, ribs and one-way slabs. It allows for various load patterns where live load is applied on selected spans and maximum shear force and bending moment values are obtained by the envelope curves. This simplified and approximate method allows also for the real rotation restraint at external supports, where the real moment is not equal to zero. Elastic analysis gives systematic zero moment values at all external pin supports. The coefficient method is thus more realistic but is only valid for standard cases. It is advised to use this method whenever its conditions of application are satisfied. Elastic analysis should be used only if the conditions of the code method are not satisfied.



Conditions of application of the ACI / SBC method:

1. Two spans or more
2. Spans not too different. Ratio of any two adjacent spans less or equal to 1.2.

   For two successive spans (i) and (i+1), we must have : $\dfrac{Max(L_i, L_{i+1})}{Min(L_i, L_{i+1})} \leq 1.2$

3. Uniform loading
4. Unfactored live load less or equal to three times unfactored dead load: $LL \leq 3DL$
5. Beams with prismatic sections

Ultimate bending moment and shear force are given in terms of coefficients by:

$$M_u = C_m w_u (l_n)^2 \qquad\qquad V_u = C_v w_u \left(\frac{l_n}{2}\right)$$

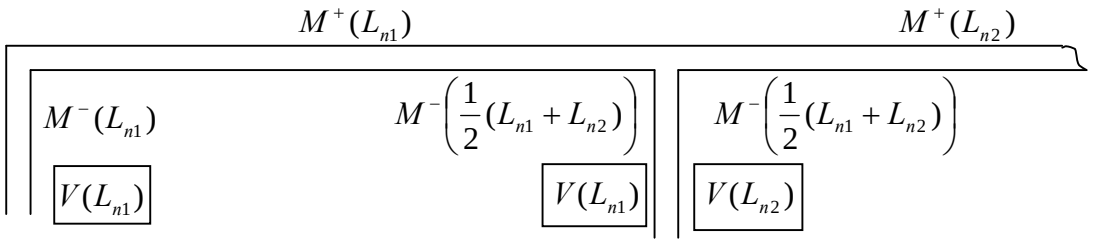
l_n is the clear length w_u is the factored uniform load

For shear force, span positive moment and external negative moment, l_n is the clear length of the span

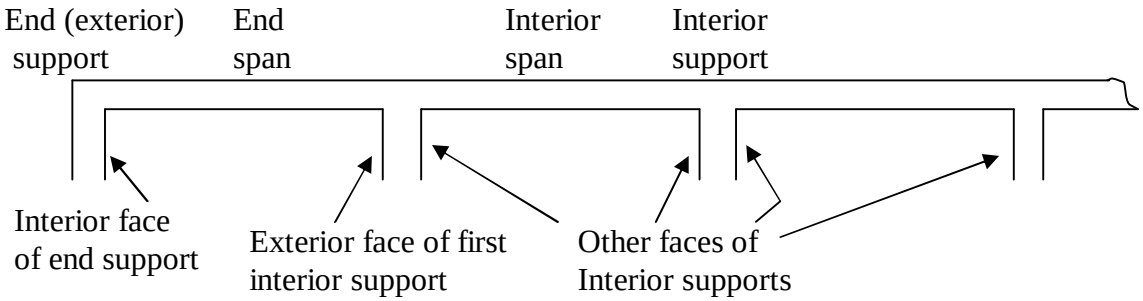
For internal negative moment, l_n is the average of clear lengths of the adjacent spans.

C_m and C_v are the moment and shear coefficients given by ACI tables

The following figure shows the appropriate clear length for each moment or shear force.



The next figure gives the ACI / SBC terminology for the various spans, support and support faces.



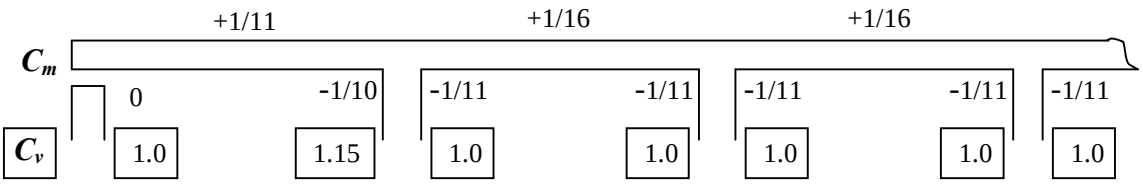
The next figures give the shear force and bending moment coefficients according to the number of spans.

Positive and negative moment coefficients are given. Shear force coefficient are also given with a rectangular border.

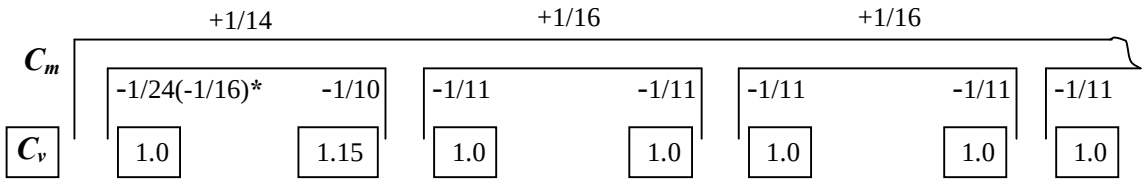
Case (a): This case corresponds to an external support not integrated with the beam. This occurs for instance when the beam is supported by a precast column.

Case (b) and Case (c): These are standard situations with two spans (c) or more than two spans (b). The moment coefficient at the external support depends on the type of support

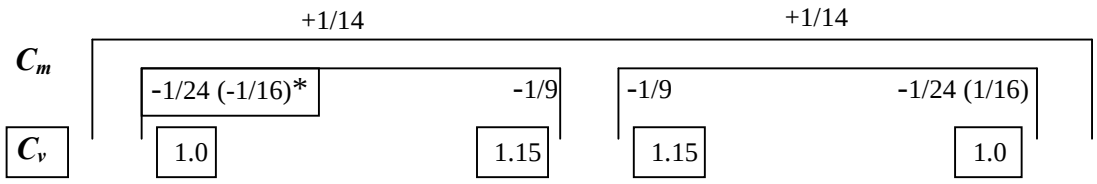
a/ Unrestrained end – More than 2 spans



b/ Integral end – More than 2 spans



c / Integral end with 2 spans



Moment and shear force coefficients

* : The exterior negative moment depends on the type of support
If the support is a beam or a girder, the coefficient is: -1/24
If the support is a column, the coefficient is: -1/16