In order to achieve durability of flat roofs with external insulation, it is necessary to secure proper drainage of the roof, i.e. to avoid water leaking into the insulation. The design of the tapered insulation of the roof is quite difficult as requirements with respect to both drainage and insulation has to be fulfilled. Based on a given design of the tapered insulation the total heat loss coefficient of the roof can be calculated using formulae in EN ISO 6946 for typical segments of the tapered insulation. Performing design and calculations for large roofs with numerous different segments can be quite tedious, and therefore a method to generate and optimize solutions has been developed and implemented in a program that also takes into account the effects of different types of thermal bridges, i.e. roof windows, insulation fasteners, roof/wall joints etc. This paper describes a new method for design of flat roofs and a pc-program that can be used for calculating the total heat loss coefficient of externally insulated roofs with insulation in tapered layers, taking into account thermal bridges in the roof construction.