Therefore, number of users = total traffic intensity / traffic per user
= 9.0/0.029 = 310 users
= 310 users/5 sq km = 62 users/sq km

(b) Given $\lambda = 1$, holding time
$H = A_u/\lambda = 0.029$ hour = 104.4 seconds.
The probability that a delayed call will have to wait longer than 10 s is
$Pr[delay > t | delay] = \exp(-(C - A)t/H)$
$= \exp(-(15 - 9.0)10/104.4) = 56.29\%$

(c) Given $Pr[delay > 0] = 5\% = 0.05$
Probability that a call is delayed more than 10 seconds,
$Pr[delay > 10] = Pr[delay > 0]Pr[delay > t | delay]$
$= 0.05 \times 0.5629 = 2.81\%$

Trunking efficiency is a measure of the number of users which can be offered a particular GOS with a particular configuration of fixed channels. The way in which channels are grouped can substantially alter the number of users handled by a trunked system. For example, from Table 3.4, 10 trunked channels at a GOS of 0.01 can support 4.46 Erlangs of traffic, whereas two groups of five trunked channels can support 2×1.36 Erlangs, or 2.72 Erlangs of traffic. Clearly, 10 channels trunked together support 60% more traffic at a specific GOS than do two five channel trunks! It should be clear that the allocation of channels in a trunked radio system has a major impact on overall system capacity.

3.7 Improving Coverage and Capacity in Cellular Systems

As the demand for wireless service increases, the number of channels assigned to a cell eventually becomes insufficient to support the required number of users. At this point, cellular design techniques are needed to provide more channels per unit coverage area. Techniques such as *cell splitting*, *sectoring*, and *coverage zone approaches* are used in practice to expand the capacity of cellular systems. Cell splitting allows an orderly growth of the cellular system. Sectoring uses directional antennas to further control the interference and frequency reuse of channels. The *zone microcell* concept distributes the coverage of a cell and extends the cell boundary to hard-to-reach places. While cell splitting increases the number of base stations in order to increase capacity, sectoring and zone microcells rely on base station antenna placements to improve capacity by reducing co-channel interference. Cell splitting and zone microcell techniques do not suffer the trunking inefficiencies experienced by sectored cells, and enable the base station to oversee all handoff chores related to the microcells, thus reducing the computational load at the MSC. These popular capacity improvement techniques will be explained in detail.

3.7.1 Cell Splitting

Cell splitting is the process of subdividing a congested cell into smaller cells, each with its own base station and a corresponding reduction in antenna height and transmitter power. Cell splitting increases the capacity of a cellular system since it increases the number of times that chan-