example) has been used to relate wider joint spacings with given areas of reinforcing bars or welded wire fabric.

- **Spans Soft Spots in Subgrade**
  During the construction process of grading, filling, and compacting of the subgrade system, it is not uncommon to encounter or produce soft spots. These can occur due to local moisture, last-minute excavation for a drain line, or similar occurrences. The reinforced slab-on-grade will span these so-called soft spots by providing enough structural capacity to bridge the weaker supporting areas.

- **Adds Restraint to Curling**
  Reinforcement in the upper half of the concrete slab will act as a restraint to concrete shrinkage. When the shrinkage in the upper portion of the slab is restrained, and thereby lessened, curling will be reduced. The closer the steel is to the top and the more steel area there is, the more the curling will be reduced.

- **Adds Structural Strength After Cracking**
  When overloading occurs, such that the cracking moment limit of the concrete slab has been exceeded, structural cracks may occur. The steel will then act as structural reinforcement and provide moment capacity according to normal, cracked-section, reinforced concrete theory. This concept may also be intentionally used in the original design concept of the slab; that is, designing the slab to have structurally-active reinforcement under externally applied loadings.

- **Increases Resistance to Impact**
  In numerous slab applications, loading is such that impact is caused on the slab. Such loading increases the stress level in the concrete. Reinforcement will reduce the strains caused by the impact loading, thereby preventing premature cracking, and provide structural strength to the slab if the impact is so much that cracking does actually occur.

- **Reduces Slab and Joint Maintenance**
  When cracks are maintained in a tighter condition and when curling is reduced, both by the presence of reinforcing steel, maintenance of these items is reduced. With supported steel in the top half of the slab, the maintenance costs should be substantially reduced.

- **Allows Construction of a "No-Joint" Slab**
  With reinforcement, construction joints may be spaced according to the planned size of a single day's concrete placement. This can be in strip shape or large panel shape. In such a slab, no contraction joints are used. The distributed reinforcement allows acceptable hairline cracking due to drying shrinkage.

- **Required for Shrinkage Compensating Concrete**
  The use of shrinkage-compensating concrete demands the use of reinforcing steel. All the advantages of the steel will exist even though the steel is required for the concrete to expand and contract as planned.

- **Avoids Use of Thickened Slabs at Joints and Edges**
  Reinforcing steel can be selected to give the concrete slab adequate strength at the joints. This will allow the slab to maintain a constant thickness without thickening at joints or edges. This thickening adds more restraint to drying shrinkage as well as requiring additional construction effort and costs.

- **Gives Confidence when Conditions of Support are in Doubt**
  It is common for a slab-on-grade to be planned and designed without a complete report on the soil, fill material, or the subgrade support capability. The presence of **reinforcing bars or welded wire fabric** creates a confidence in the ability of the slab to perform adequately even though some doubt may exist concerning the subgrade support.

THE GENERAL PROCESS OF DESIGN

The design of a slab-on-grade includes all decisions and details made before the job is bid and constructed. Three of the more obvious items included in the design process are slab thickness, reinforcement requirements and joint spacings. After determining the controlling loadings, the appropriate safety factor, and the subgrade modulus appropriate for the base and fill materials, the designer determines the required thickness.

References for thickness determination include publications of the Portland Cement Association, the American Concrete Institute, the Concrete Reinforcing Steel Institute, and the Wire Reinforcement Institute.

The next most common step is the selection of the reinforcing steel area (bar or wire size and their spacing) along with an acceptable joint spacing. Both of these involve knowing the slab's performance requirements such as lanes of traffic, aisle and storage rack placements, flatness requirements, joint details, dowel recommendations and the like. Reinforcing steel, in the form of welded wire fabric or patterns of deformed bars, is then selected for purposes of either crack control,