



WIRE REINFORCEMENT INSTITUTE®

# TECH FACTS Excellence Set in Concrete®

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## Properly Placed WWR Provides Quality Concrete Sidewalks

A city like New York City with its many millions of square feet of sidewalk needs to build them for a lot of different loadings - pedestrians, exhibits, trucks, tractors, machinery - you name it. What loads do you use in your designs?

New York City does it right! They use properly designed and supported structural welded wire reinforcement (WWR) in their sidewalks.



The section of sidewalk depicted in the photographs was discovered in mid-town Manhattan and was photographed in the Spring of 2005. The

reinforcement is 4x4 - W 2.9x2.9 WWR in flat sheets, which are uniformly placed to provide the required cover. Rows of continuous chair supports formed from galvanized wire were spaced at 3' centers.



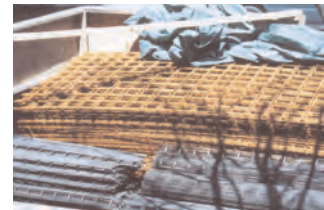
*Paladino Construction, located at 844 Pine Street, Brooklyn, NY 11208, was the concrete placing contractor. The sidewalks and paving standards are the City and New York State Department of Transportation specifications.*

**Q&A for owners, design professionals and contractors about welded wire reinforcement or steel reinforcement.**

### 1.) "What's wrong with just using plain and or unreinforced concrete slabs and paving?"

It is true that there are higher strength and better quality concrete mix designs today. There are also improved and thicker, well compacted, granulated crushed aggregate substrates.

As we know, all concrete has the potential to crack. Understanding the potential for cracking, we plan for shrinkage to take place at control and construction joints. However, many times the slab has already cracked more randomly or at intermediate locations prior to saw-cutting or troweling. If steel reinforcement is left out and the sub grade settles there is nothing to prevent the cracks from widening or the slab from settling or displacing.



What about added reserve strength when the concrete cracks? How can one guard against wide cracks and help maintain aggregate interlock, keeping the slab in one plane? The answer to both questions is to use steel reinforcement, i.e. welded wire reinforcement as used in New York City's sidewalks. One might also consider adding paving to the process.

*What loads do you use in your designs?*

## 2.) “How much strength is added with steel reinforcement?”

Let's calculate the cracking moment or critical moment for a 4" concrete slab,  $f'_c = 4000$  psi slab.

$$M_{Cr} = bt^2/6 \times \text{MOR or } 9 f'_c \text{ or } 4000 = 570 / 12000.$$

- $M_{Cr} = 1.52$  kip-ft. Then calculate the moment capacity of the lightest cross sectional area of welded wire reinforcement (WWR) with the standard equation written:
- $M_{Steel} = A_s \times f_y (0.9d)$ , use  $d = t/2$  for each direction of wire.
- The area,  $A_{Steel}$  of 6 x 6-WI .4 x W1.4 is 0.028 sq.in /ft of concrete cross section.

Also the  $f_y$  of the steel is 75 ksi. Therefore:

- $M_{Steel} = 0.32$  kip-ft/ft.
- That moment capacity of the steel is  $0.32/1.52$  or 21% of the cracking moment of the 4" slab.

Incidentally, for the New York City project - The 6" slab has an  $M_{Cr} = 3.42$ . The 4x4 W2.9xW2.9 (WWR) has an  $M_{Steel} = 1.47$  kip-ft/ft. Therefore, the moment capacity of the steel is  $(1.47/3.42)$  or 43% of the cracking moment of the 6" concrete slab.

This demonstrates that there is a reserve strength that the steel provides when the concrete cracks. Thus, the WWR offers structural strength as well as resisting temperature and shrinkage stresses.

## 3.) “What are the Benefits of Steel Reinforced Concrete Slabs.”

- Steel reinforcing is simple to place.
- Steel reinforcing reduces random cracking.
- Steel reinforcing reduces and controls crack width and helps maintain aggregate interlock.
- Steel reinforcing controls sub grade drag caused by shrinkage and contraction.
- Displacement and curling can be minimized when steel reinforced concrete is provided.
- Strength is increased with steel reinforced concrete - Even the smallest cross sectional area of steel reinforcement will provide reserve strength of more than 20%.
- Most importantly, steel reinforcement saves money over the life of the slab or paving.

The welded wire reinforcement industry is dedicated to providing quality steel reinforcement to the construction industry. It is also essential that steel reinforcement be sized, spaced, and placed properly. For proper placing information and supporting WWR, see Tech Fact TF 702 on the WRI website, under publications ([www.wirereinforcementinstitute.org](http://www.wirereinforcementinstitute.org)). Of course, total quality can only be achieved when well qualified suppliers and contractors are on the construction sites.

*What loads do you use in your designs?*

**An Important Reminder!!** Some sidewalks are made for walking - Some are made for traffic.