WELDED WIRE REINFORCEMENT

THE SMARTER ALTERNATIVE
FOR BUILDING SMART CITIES

WELDMESH MANUFACTURER'S ASSOCIATION

http://www.weldedmesh.com

Mechanization or industrialization of any and every productive activity invariably brings benefits in all respects of quality, efficiency of time and energy and elegance of human effort . Just as mechanization of concrete production namely Mix design, Auto batching plants , Ready Mix technology and automated casting techniques have raised the quality and strengths of concrete to remarkable levels, the same is essential for reinforcement. It is high time we stopped doing the HANDICRAFT work of tying up individual bars and got SMARTER about it. Usage of Welded Wire Reinforcement (WWR) is the smarter solution for achieving the requirements of quality, reliability, speed and efficiency.

Welded Wire Fabric (WWR) is prefabricated reinforcement consisting of a series of parallel longitudinal wires with accurate spacing welded to cross wires as per Design spacings and placement length & width.It offers a Fit & forget solution to Reinforcement. The welding of the wires is achieved by electric resistance welding with solid-state electronic control and all the spacings are controlled by an automatic mechanism of high reliability. There is no foreign metal added at the joint and the intersecting wires are actually fused (liquefied) into a homogeneous section thereby ensuring permanency of spacing and alignment in either direction.

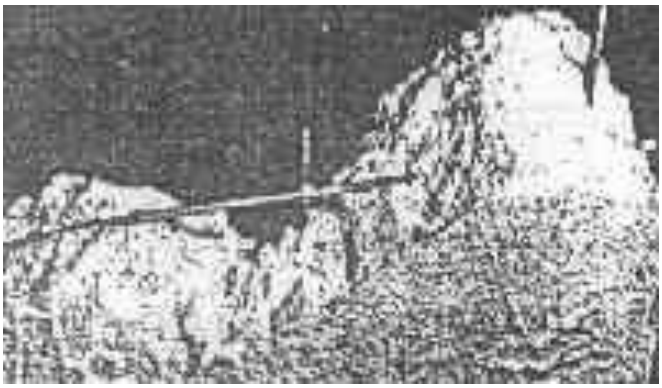
The wires used in the fabric are either cold drawn or Cold Rolled from controlled quality mild steel wire rods with carbon content generally less than 0.18%. The Cold drawing through a series of tungsten carbide dies or Cold Rolling through a set of Tungsten Carbide Rolls ,results in a increased yield strength material of accurate dimensions . Further, each section of the wire gets inherently tested by the process itself for its characteristic physical properties thereby offering a systematic reliability of material . The Cold Drawn wires conform to IS:432-Pt II/1982 which specifies an ultimate tensile strength of 570 N/mm2 and a characteristic (0.2% Proof) strength of 480 N/mm2. Wires used for manufacture of WWR are generally manufactured in the range of 4 mm to 12mm diameter.

WWR is manufactured conforming to IS:1566-1982 with long and cross wire spacings varying from 25 mm to 400 mm. Each of the rigidly welded intersection is capable of withstanding shear stresses upto 210 N/mm2(IS:4948/1974) on the reference area of the longitudinal wire. The fabric can be manufactured in widths generally upto 3500mm with lengths limited by transportation considerations. When supplied in ready to lay flat sheet form the standard length is 5500mm. Otherwise the fabric can be supplied in roll form in standard lengths of 15m,30m or 45m.

ADVANTAGES OF WELDED WIRE FABRIC

1) **HIGHER CHARACTERISTIC DESIGN STRENGTH vis-à-vis Fe415 grade**: Simply from better characteristic strength point of view, usage of WWR with Fe480 grade results in savings in steel area or steel weight required to the tune of 13.55 % vis-a-vis HYSD bars of Fe 415 grade . Cold Drawn Wires & Cold Rolled Ribbed Wires also can conform to Fe500 grade properties.

2) **BETTER BONDING BEHAVIOR:** The bonding behavior of WWR is significantly enhanced and different from that of HYSD or Plain Mild steel bars. As against the peripheral surface area which is responsible for bonding to concrete in the case of loose Rebars, the rigid mechanical interconnections or T-action by means of welds to cross wires are



primarily responsible for stress transfer from concrete to steel and vice-versa in the case of WWR. Each of the rigid welds capable of resisting upto 210 N/mm2 ensure quick and complete stress transfer within 2 welded joints from the critical section.The stress transfer from mesh to steel is via the more optimal 2-Way Plate action rather than the 1-Way Beam action as in loose rebars. This behavior of positive mechanical anchorage is acknowledged in specification of much lower lap splice lengths for WWR. A lap splice or a development length consisting of 1 cross-wire spacing comprising 2 welded intersections plus additional 100mm subject to a minimum of 150 mm total length is sufficient to develop a full strength lap. This aspect can result in savings of steel vis-a-vis HYSD bars by making easy the option to use a combination of fabrics/ steel areas provided to achieve curtailment of reinforcement with easy and short splices.

3) **BETTER AND ECONOMIC CRACK RESISTANCE WITH THINNER WIRES AND CLOSER SPACINGS:**

WWR being Machine produced affords the possibility of using thinner wires or fractional diameters at closer spacings. This serves most effectively in countering the non-load phenomena or strain induced stresses due to Shrinkage and Temperature changes. The close spacing of thinner wires and the two-way behavior of WWR minimizes the crack widths and preserves structural integrity of the slab. In cases where a designer is constrained to provide more than minimum reinforcement from the maximum bar spacing criteria, WWR affords enormous savings by providing reliable fabric with thinner wires at closer spacings. For instance consider very common cases in residential slabs where load stresses are low but where minimum thicknesses of 75 to 125mm are used from serviceability or other reliability criteria,

Slab Depth	Min steel. reqd.@ 0.12%	HYSD Steel provided at 3 x eff.depth max. spacing	Welded Wire Steel Fabric Close spacing	%Saving s of steel
75 Mm	90 mm^2/m	Y8 @ 165c/c= 303mm^2/m	210 x210-5mm dia = 93.5 mm^2/m	69%
100 Mm	120 mm^2/m	Y8@ 240c/c= 209mm^2/m	150x150-5mm dia = 130 mm^2/m	37%
125 Mm	150 mm^2/m	Y8@310c/c= 162mm^2 /m	130x130-5.0mm dia =150 mm^2/m	8.0%

The above aspect can be exploited to achieve savings in various cases of even designed steel area zones by providing minimum steel of suitable thinner WWR over all the zones and then adding extra layers of thicker designed steel WWR in the stressed zones of a slab.

4) **SAVINGS OF LABOUR, BINDING WIRE & TIME :** The most important USP of WWR is the immediate and positive savings in labour and time. It is complete freedom from all the mundane fitter's jobs. There is **no cutting of bars, no marking and spacing them out , and above all no laborious tying of binding wires.** There is saving of skilled fitters manpower and saving of helpers to cut and tie.

The fabric is available ready to lay on the shuttering. It is also ready for casting as the need for supervisors/ engineers to check the bar sizes & spacings is eliminated. The enormous savings in man-days and the associated cost vary from project to project depending upon the scale of the job and the repeatability of design. Faster execution leading to faster recovery of blocked capital with consequent Interest savings.

TIME IS MONEY: Assuming say cutting down of Slab Steel placement time from 48 hours to 4 hours for say a 500 sq.mtr Floor plate with approximately 5 kgs/sqmtr Slab steel or 2.5 MT/Floor and savings of say 15 days out of 30 days construction cycle for Low Cost Housing structure – Reduction of floor wise cycle from 4 days to 2 days . .

Savings of Interest on investment due to faster construction cycle assuming 10% Interest and Basic RCC construction cost @ Rs 10000/sq.mtr. 10%p.a Interest for 15 days of Rs 10000/Sq.mtr x 500sq.mtr x 7 floors/month = **Rs 143835 Interest savings while using 20 MT of Steel (worth 8.60 Lakhs) i.e : approx 16.73%**

ECONOMICS:

Every solution apart from providing efficiency , savings and elegance of process, has to prove cost-effective in the final analysis vis-a-vis other alternative solutions. The potential of WWR as a strong catalyst for accelerated infra-structural development has yet to be experienced in the Indian context. It needs the involvement and appreciation of the planners, builders, consultants and contractors in the Industry.

A cost comparison between the competing alternatives of WWR and HYSD bars can be only appreciated by considering the total picture of final costs. A brief comparison on ton basis with present day costs (April. 2017) is as follows:

AS ON 15th April 2017	***Rupees / M.Ton***
HYSD – Fe415 Grade Bars Add: VAT @ 5%	40,500 2,025
1) Extra steel: due to lower strength @ 13.55%	5,490
2)Wastage in cutting bending on site @ 2%	850
3)Binding Wire consumed @ 1 to 3% average @ 2%	850
4)Cost of Labour in cutting fitting, tying, handling @ 8000/ton	8,000
	57,715
WELDED WIRE FABRIC Add national average VAT @ 6% :	52,000 **3,120** ***55,120***

NO OTHER COSTS BUT:

1) Savings of Time which is invaluable but not easily comprehended.
2) Savings of supervisory manpower
3) Elegance of Use.
4) Quality and Reliability of the factory controlled reinforcement.
5) Much better Quality of Crack-free Concrete

APPLICATIONS FOR WELDED WIRE FABRIC: The elegance and tremendous savings in time, cost and energy achieved by WWR usage lend it amenable to applications in a wide spectrum of construction works. Any reinforcement requirement in flat form can be provided with WWR. A brief listing of possible areas of usage include:

1) Structural Flat slabs or in slabs with Beam Slab construction.

2) Large area Floor slabs on ground, pavements, airport runways, aprons etc to achieve crack-free joint less surfaces.

3) Concrete elements of curved or difficult shapes such as arches, domes, lotus petals etc. where the flexibility of WWR and its ready to us nature aids all the way.

4) Precast elements which are thin or are difficult to reinforce such as curved arch flat members, Hyperbolic Paraboloid Shells, folded plate roof girders, fins, thin pardis or chajja drops.

5) Standard mass production precast R.C.C and prestressed elements like slab panels, wall panels where the combination of factory production mechanisms, ready to lay WWR sheets and controlled concrete can result in excellent results with efficiency and quality in all aspects.

7) Unstressed Shaping or Form Reinforcment used in Prestressed Concrete Girders of Box,I , T or Double T-section. Here WWR with its thin profile is particularly essential since the flanges, web etc of these efficient sections are themselves are quite thin and usage of thick individual bars with the special cover requirements can cause severe congestion for the prestressing tendon ducts.

8) Ferrocement or Ferrocrete works where WWR is the only solution for forming the reinforcing matrix along with chicken mesh to develop thin and efficient precast elements such as water tanks, fins, shelves etc.