

TATA STEEL



Converse to Construct

Construction Solutions from Tata Steel

7th July, 2020



Evolution of steel reinforcements - Globally countries have traversed this curve from straight rebars to Ready to use rebars

Straight Rebars

- Mild Steel (250 MPA)
- TMT(415 to 600 MPA)
- CRS, epoxy coated

Cut & Bent Rebars

- Cut to Length bars.
- Cut & Bend bars as per BBS

Welded Wire Fabric (WWF)

- Slab, wall, drain meshes
- Drop panel mesh
- Stirrup cage made from mesh
- F-mesh , Carpet mesh

Cages

- Pile cages
- Column pre-cages, Beam pre-cages
- D-wall



Shortage of labour made these countries move ahead in the maturity curve .
But going forward, **stringent timelines** would necessitate improving productivity in reinforcement placement

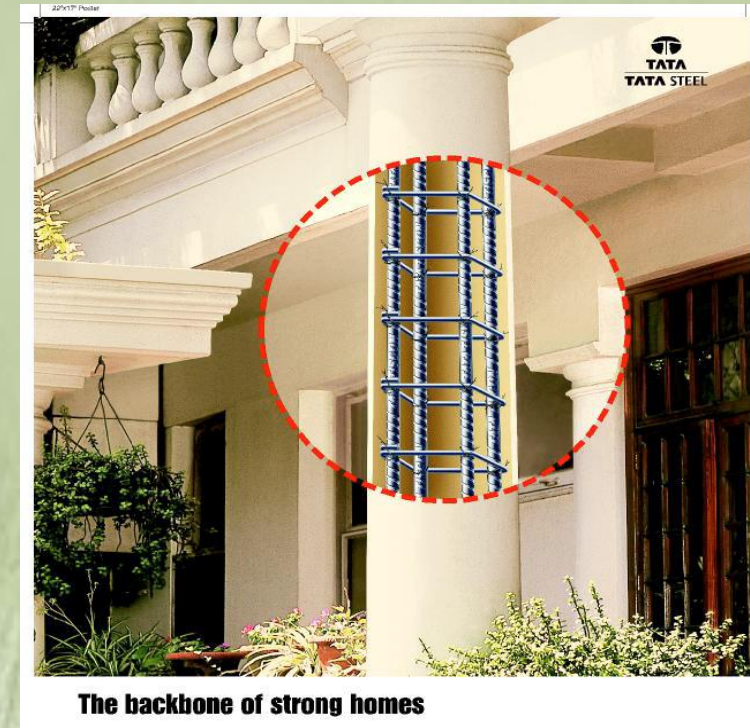
Tata Steel has also focussed on providing construction solutions on steel reinforcements



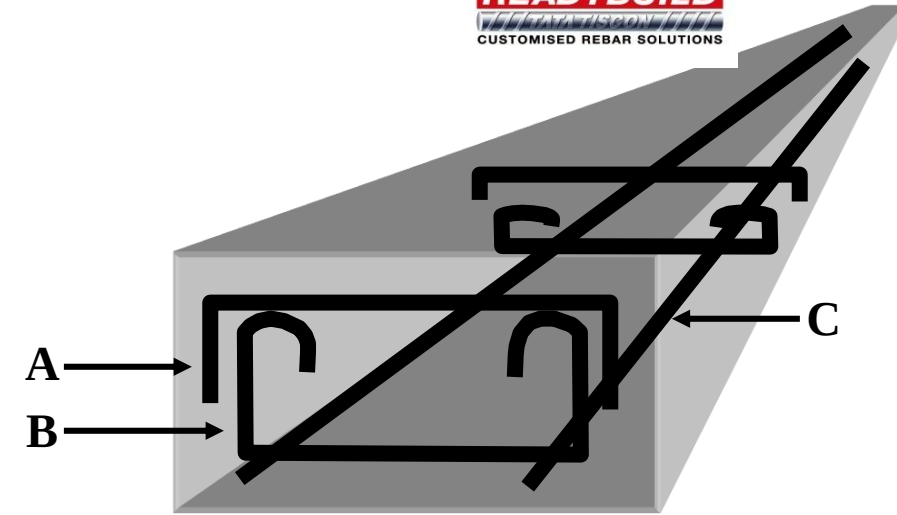
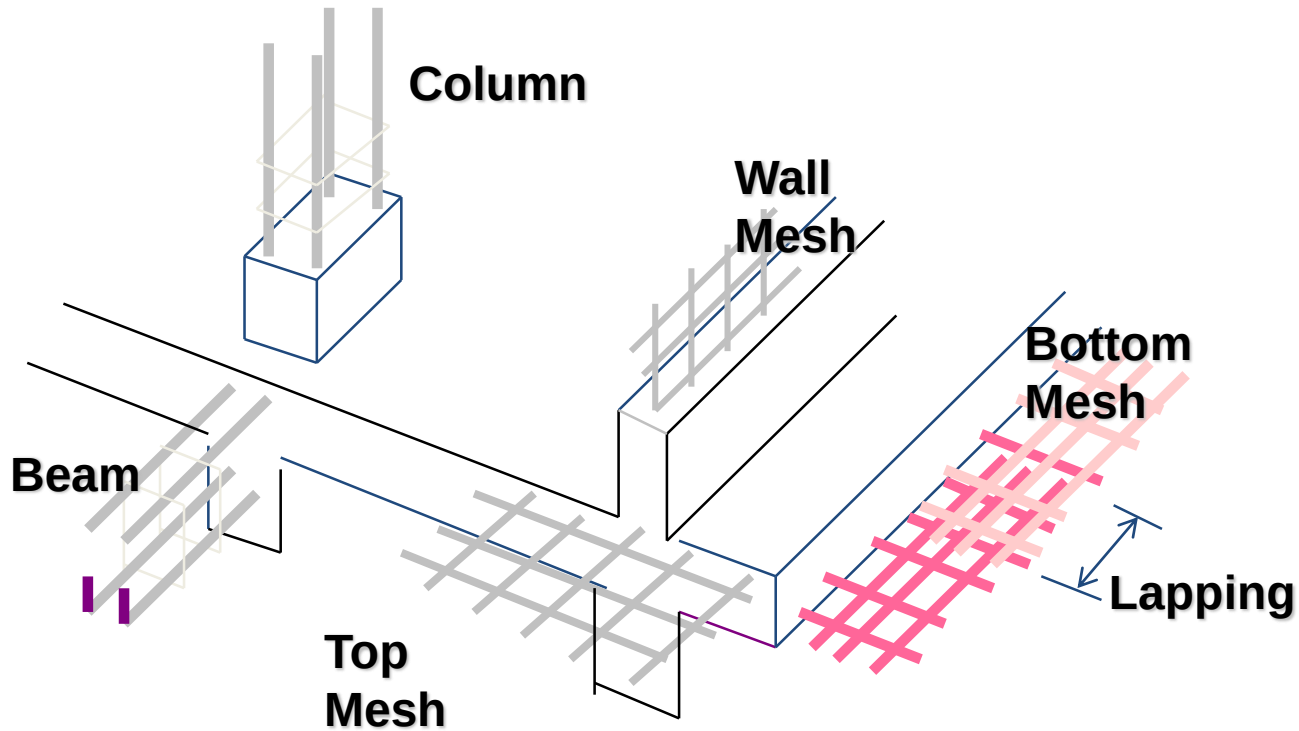
Cut & Bend Rebars



A Construction
Solution from Tata
Steel



Each Element of Structure needs to be detailed in BBS form
for Ordering Cut & Bend



Beam

BBS should have the following :

1. Element : Beam #1

Barmark :

- i. A – 20 Nos. Φ 16
- ii. B - 20 Nos. Φ 16
- iii. C - 3 Nos. Φ 20

2. Element : Beam # 2

Barmark :

Barmark has Shape & dimensions

BAR BENDING SCHEDULE (BBS): SAMPLE

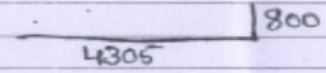
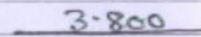
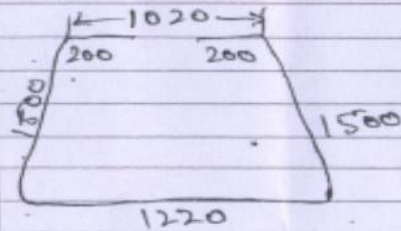
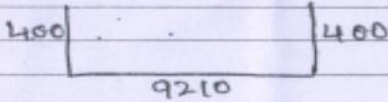
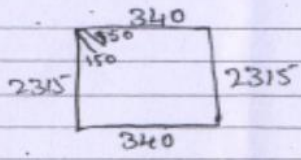
BAR BENDING SCHEDULE

①/④

Client : National Highway Authority of India
Concessionarie : Bangalore Elevated Tollway Limited
Contractor : Soma Enterprise Limited

Date: 4/10/08

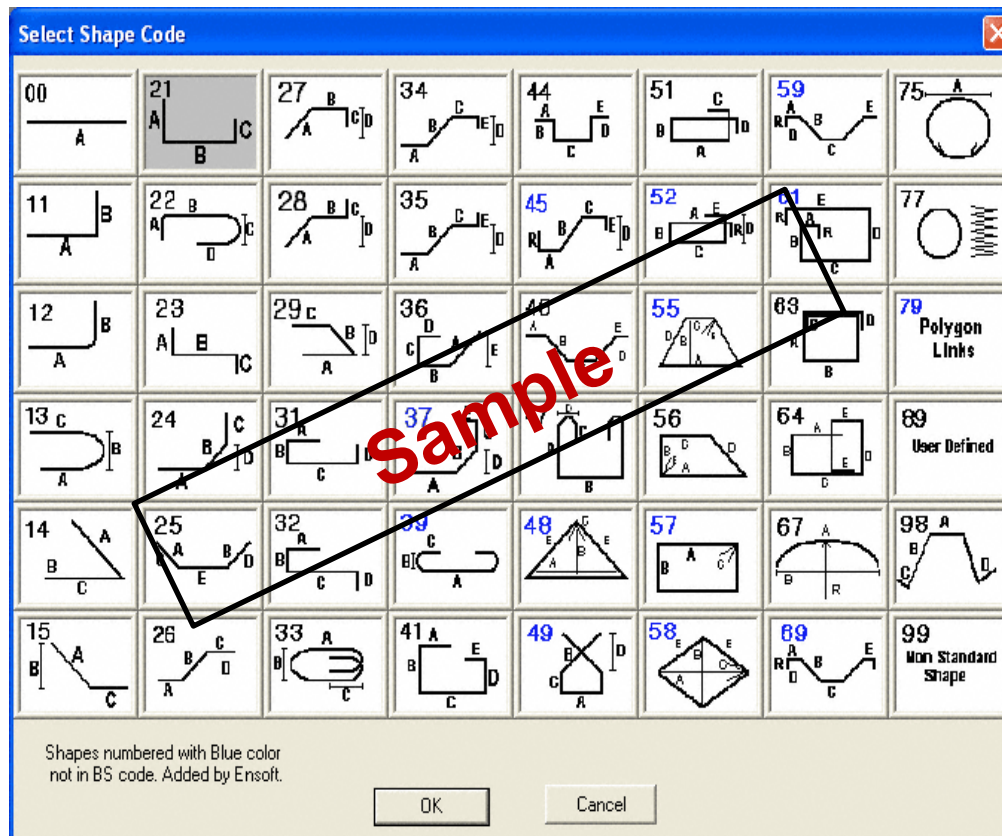
Deck Slab (Intermediate diaphragm)

Sl.No	Description	Shape	Bar Mark	Dia	Cut Length	Nos	Total Length	Wt. / Mtr	Total Wt.
1)			56	12φ	5.105	64	326.72	0.888	290.12
			56	12φ	3.800	32	121.6	0.888	107.98
2)			64	12φ	4.570	16	73.12	0.888	64.93
3)			65	12φ	10.000	4	40.000	0.888	35.52
4)			57	12φ	5.550	40	222.000	0.888	197.136
									695.680
Total wt in M.T = 2.134									

Section Incharge

Bar Bending Schedule Service

- A Bar Bending Schedule is a detailed representation of Cut and Bend rebars
- It determines the quantity, shape, and weight of the reinforcement used for construction and is an output of a structural drawing. A schematic is shown below for representative purposes
- BBS work is generally perceived to be a tedious task that adds little value. Good resources are hard to get and unstable. Hence, Tata Steel has added the service in it's portfolio under 'Readybuild' to provide value



Structural drawing
is received from
customer

Structural drawing
is converted to a
BBS

BBS is given to the
customer for
approval

Approved BBS is
given to ReadyBuild
centre

Loading list is
generated

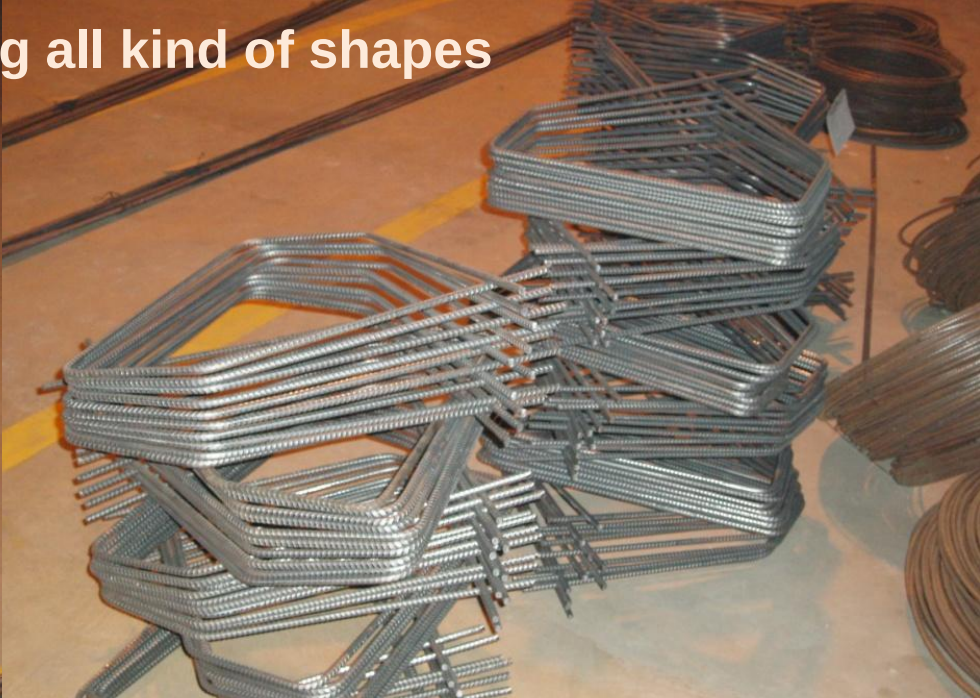
Production is made
as per the Bar
Coded Card

Our centres are capable of producing all kind of shapes



With High Tensile Steel Straps

	Order Id: TC-20170621-1111	
	Client: Tribeni Construction Ltd.	
	Element: PC5(1)	
	BM: BM_82	
	Dia: 32 Len: 2677	
Pin: 128 Qty: 2(2)	Wt: 33.81	
Grade: IS1786 Fe500D	T	
Remarks: Pile Cap		
Tag Desc:		PO No: 257
		Tag Id: 120-1

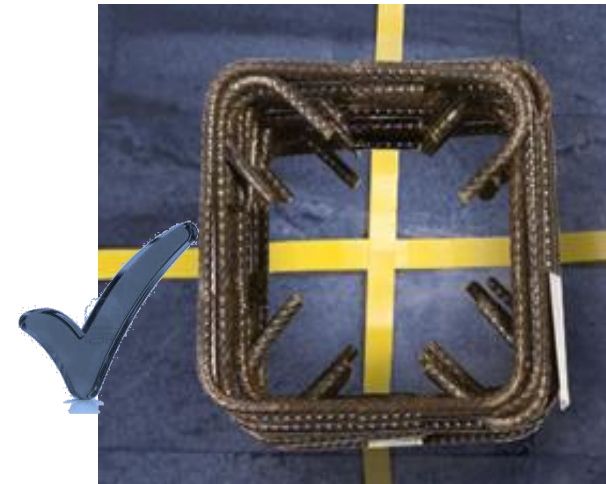
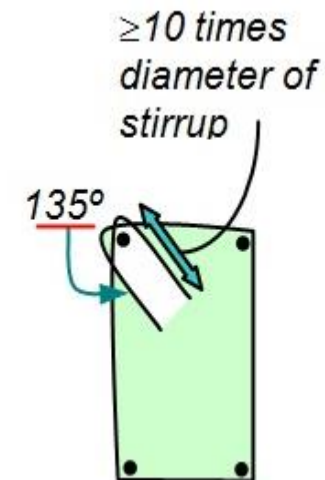


How ReadyBuild improves quality.....

Ensures proper
Development Lengths –
Ex. in Column Footing



A stirrup with 135° bend
gets properly embedded
inside concrete and does
not open out during load
condition like earthquake



Readybuild Addresses Customer Pain Points



Moving Sites (Transmission towers)



Difficult Shapes (Helical)



Space Constraints (in congested areas)



Repeat Structures (Bridges, Towers)

Other advantages of Readybuild (Cut & Bend)



Space management

- Taking essential care of site constraints
- Saving on rental and maintenance



No wastage

- 5%-7% wastage at site
- Saving the customer ~Rs 2000-3000 per MT



Inventory management

- Saving on the customer's inventory cost
- 1% for 30 days~ Rs 400 per MT



Quality control

- State of the art machinery at our centres
- High precision and best quality products



Hassle-free Procurement

- Timely availability of SKUs
- Delivery of material when required



No labour-related worries

- Saving on customer's labour costs
- High accuracy products with auto tagging

helped faster casting of segments for underground tunnels



Spirals for Segments for Underground Tunnels

TISCON READYBUILD COUPLERS



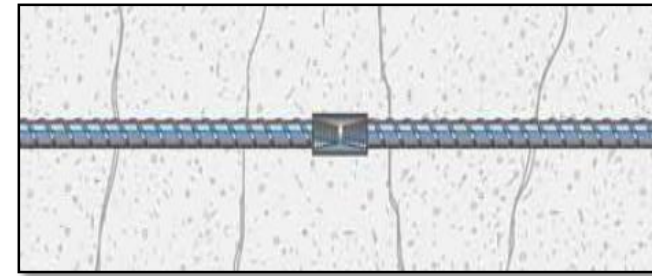
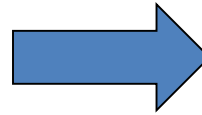
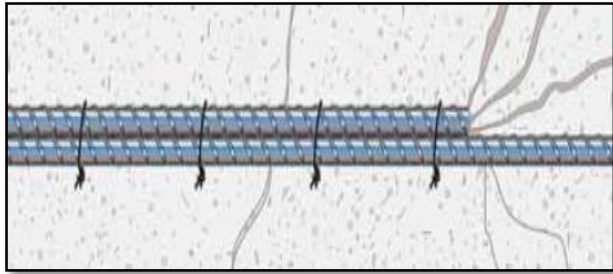
**A Construction
Solution from Tata
Steel**





COUPLERS – A REPLACEMENT TO LAPPING

Couplers are members used to align and permanently hold in position two discrete pieces of reinforcement bars during assembly at the construction site.



The lap lengths are governed in India by the IS code IS 456 2000. The lap lengths for the different cement grades, in different locations prescribed are as below.

Concrete Grade		M 20	M 25	M 30	M 35	M 40
Bars in Tension	Fe 500	57 Φ	49 Φ	45 Φ	40 Φ	36 Φ
	Fe 600	68 Φ	58 Φ	54 Φ	48 Φ	43 Φ
Bars in Compression	Fe 500	45 Φ	39 Φ	36 Φ	32 Φ	29 Φ
	Fe 600	54 Φ	47 Φ	43 Φ	38 Φ	34 Φ



Areas of application:

- Wall to slab connection
- Column-lap replacement
- Future extensions/additions
- Beam to column connection
- Raft foundations
- Precast elements

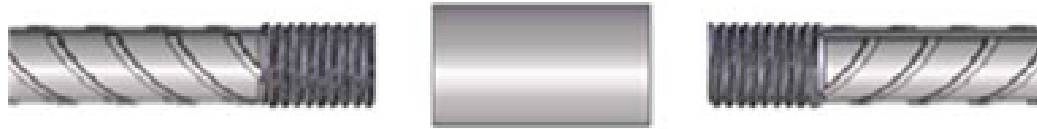
Refer Code IS 16172



HOW TO ASSEMBLE THEM

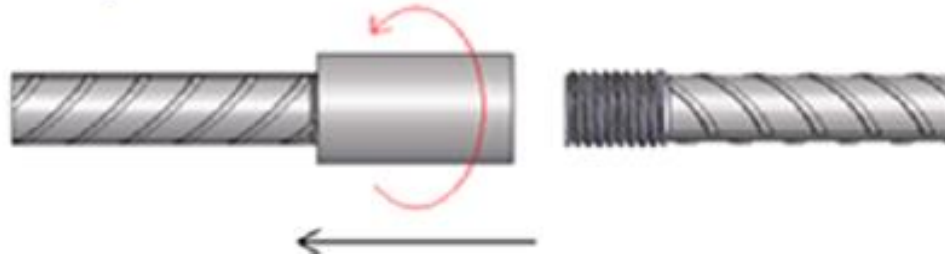
The assembly process of coupler compared to lapping is very easy

1



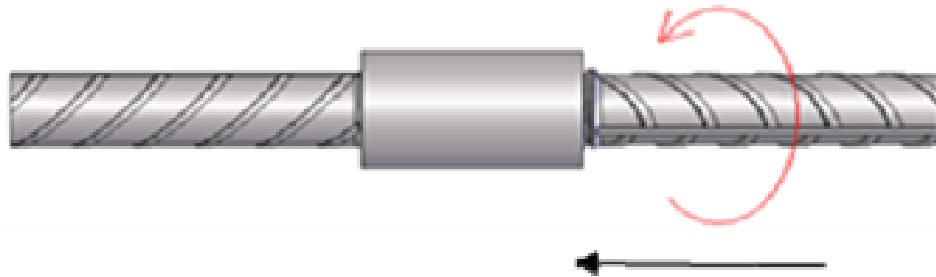
Ends of the rebars which are to be joined arrive at site in threaded form

2



Coupler is screwed on to the fixed rebar, which is already assembled

3



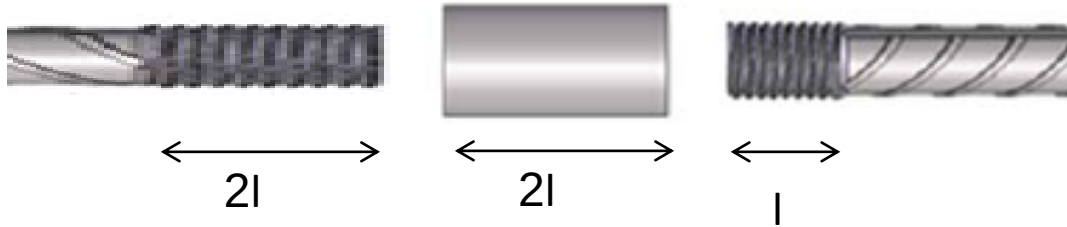
The free rebar is screwed on to the coupler and now the assembly is ready



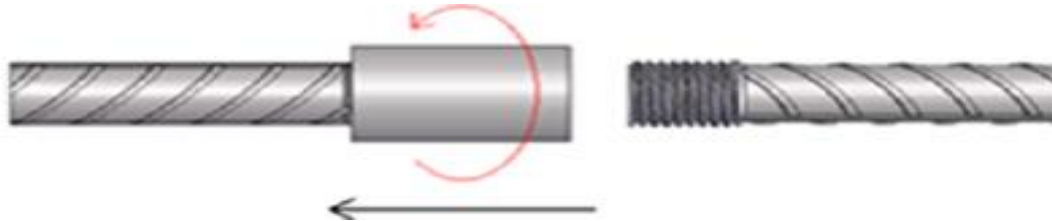
HOW TO ASSEMBLE THEM (TYPE B)

In case there is difficulty in rotating the second rebar, longer threads are provided in the first rebar

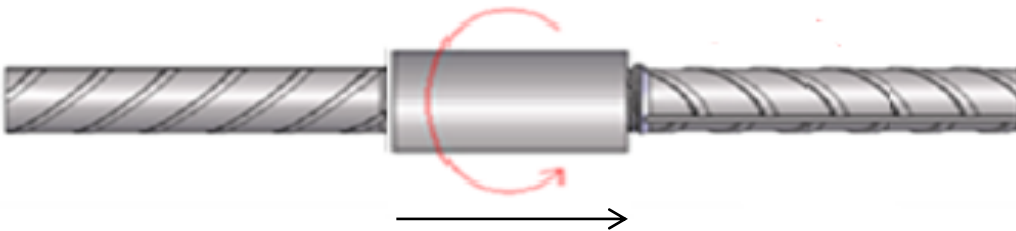
1



2



3



- The Length of the fixed rebar is kept at twice the usual length and equal to the length of the coupler
- The coupler is screwed on to the fixed rebar to the entire length of the thread, which is already fixed
- The free rebar is held in position and the coupler is unscrewed on to the free rebar and now the assembly is ready

So there is no rotation of the free bar in this case



MANUFACTURING OF THREADED REBARS

Step 1: Cutting of rebar

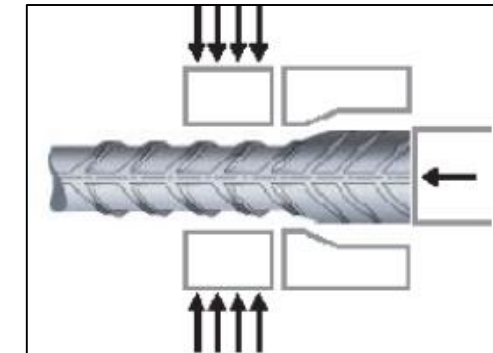
- The end of the reinforcing bar is sawn square
- Machinery that is required to do so is a band saw



Step 1

Step 2: Cold Forging of rebar end

- Sawn end is enlarged by cold forging/upsetting
- Core diameter is increased to a pre-determined diameter
- Cold forging machine is used in this operation



Step 2

Step 3: Threading of the forged end

- Thread is cut on the enlarged end of the bar
- Threading lathes are used for this process



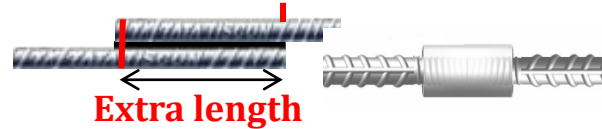
Step 3

BENEFITS OF USING COUPLERS

LAPPING

Rebars held together over extra lap length & wound together using binding wires

REDUCED REBAR USAGE

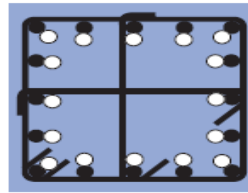


Eliminate lap length completely & saves on rebars

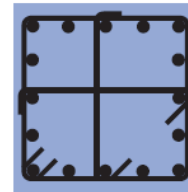
REDUCED CONGESTION IN BEAMS/COLUMNS & FASTER ASSEMBLY

Laps increase congestion in lap zones & are responsible for unsound concreting

Lapping installation is time consuming & manpower intensive



Lapping



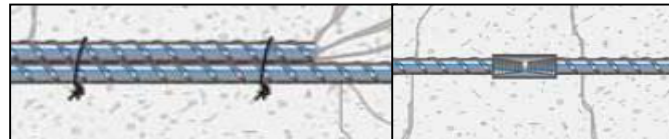
w/o Lap

Enhanced concrete flow thru reduced congestion & eliminates costly concrete rework

Couplers have quicker installation times & require less of manpower

HIGHER STRUCTURAL INTEGRITY

Non-linear load transfer & greater dependency on concrete for load transfers



Lapping

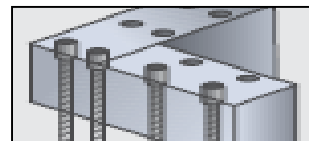
w/o Lap

Low dependence on concrete for load transfer

Ideal steel to concrete ratio

EASIER FUTURE EXTENSIONS & REPAIRS

Dowel bars & tie bars get damaged/deformed in the course of construction & require repair and rework



Easy substitute for dowel ends & tie bar
Can easily extend from a coupled free end closed with a plastic cap



ADDITIONAL BENEFITS OF READYBUILD COUPLER

SUPERIOR DESIGN

- Machined outer surface and perfectly cylindrical pieces ensures uniformity in behavior under load
- Higher factor of safety (greater length & outer diameter) than BIS code ensures improved design safety

SUPERIOR QUALITY CONTROL

- Made in accordance with Indian Standard IS 16172:2014 & EN 1992
- 100% dimension testing on coupler and rebar thread ensures quality of material
- Chemical testing of every batch of raw material ensures chemistry of the couplers

OFFSITE THREADING WITH C&B

- Option of Threading off-site (MoQ is a vehicle load)
- Option of Cut, Bent & thread rebar supplies as per BBS
- Supplies bundled tagged and delivered

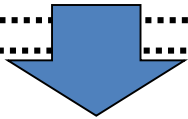


THE ORDER FLOW

ORDERING

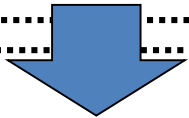
Current Bar Bending Schedule - **BBS modified**

- a. Extra lap length at joints removed
- b. Replaced by threads on the rebars



PROCESSING

Based on modified BBS - Rebars are Cut, Threaded and Bent (CTB) at the automated Authorized Service Provider



SUPPLIES

Supplies of these CTB rebars are made along with relevant couplers, on the agreed dates, Ready for assembly



MoQ as per
vehicle load
restrictions only



COMPLIANCE AND CERTIFICATION

- The couplers are made compliant to Indian standards of **IS 16172 : 2014** & International standards - **EN 1992 Eurocode**
- The couplers would be supplied along with the below certificates
 1. Parent Material Test Certificate including physical and chemical test
 - To ensure quality of the parent material being used for making couplers
 2. Physical Dimension Test certificate of samples of the batch
 - To ensure manufacture as per design
 3. Sample Pull test from the lot
 - To ensure physical properties of the joint are met
 - Requires failure at rebar and not at joint

5.7.2 Reinforcing Steel

CRITERIA FOR STRUCTURAL SAFETY OF TALL BUILDINGS - applicable for reinforced concrete (RC) buildings of heights greater than 45 m, but less than 250 m,

5.7.2.1 The characteristic yield strength of the steel reinforcement bars *used in construction* shall not exceed 1.2 times the value used in design.

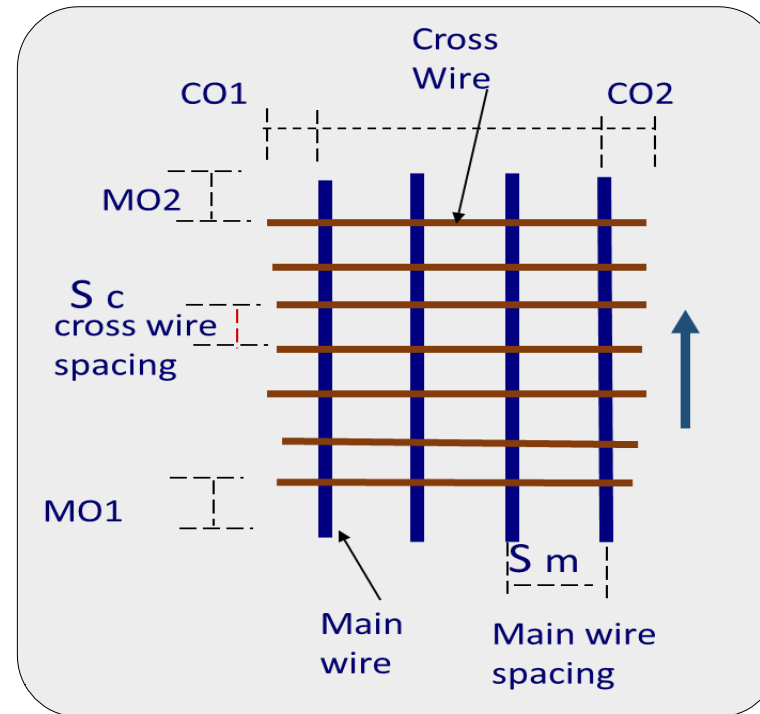
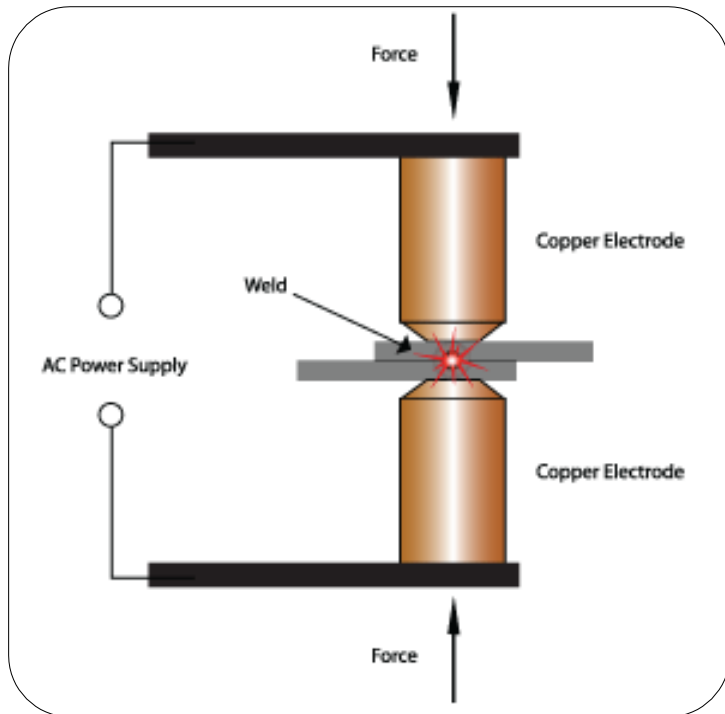
5.7.2.2 The ultimate strength of reinforcement bars shall not exceed 1.25 times the characteristic yield strength.

5.7.2.3 No lapping of bars shall be allowed in RC beams, columns and walls, when diameter of bars is 16mm or higher; mechanical couplers shall be used to extend bars.

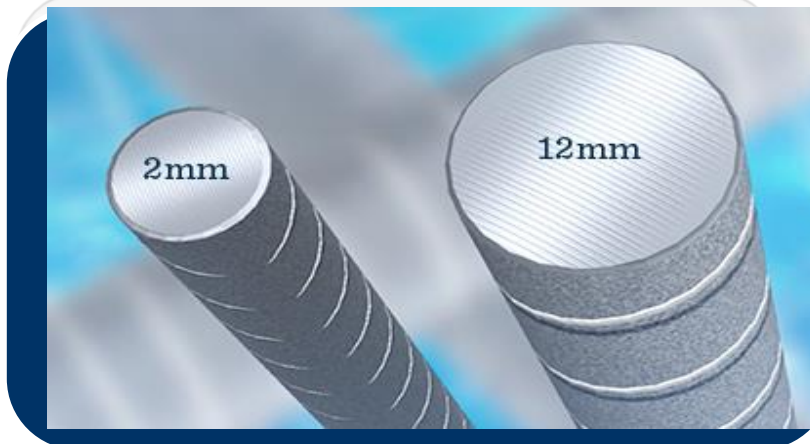
Sm@rtFAB

A Tata Steel Solution

Configuration of Welded Wire Fabric is defined by spacing and positioning of wires.



Cold-drawn ribbed wire with electric resistance fusion welding.
In square or rectangular grids.



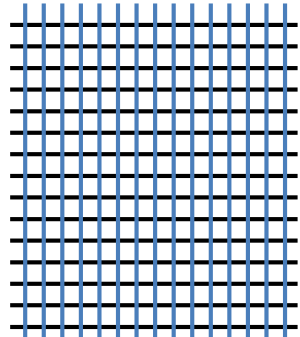
Ribbed Fusion Welded
Wire Fabric

Customised Flat Welded Wire Fabric (WWF) – Sm@rtFAB being offered by TSL

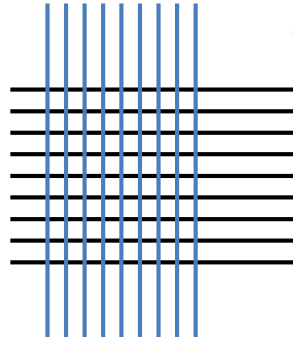
Current Offerings



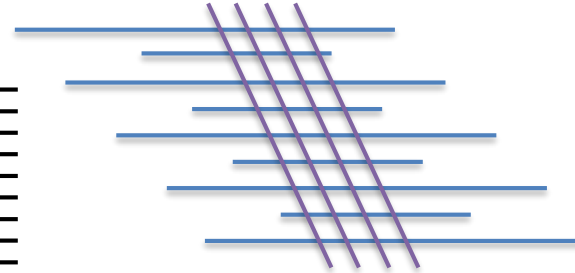
Flat WWF



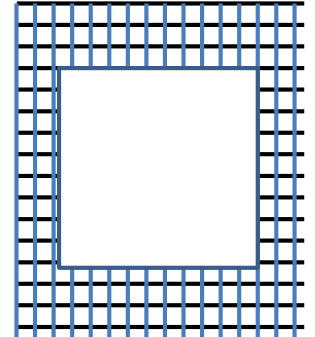
Standard



**Variable
Overhangs**

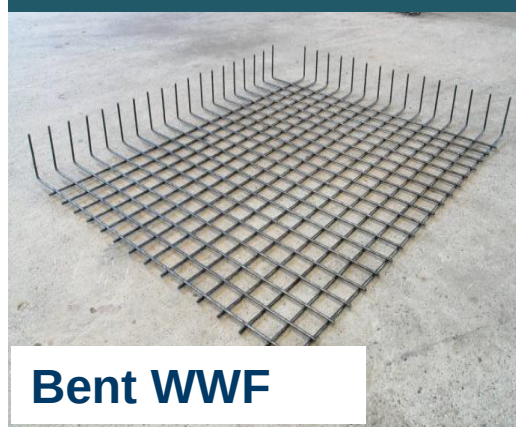


Staggered



Cut-Outs

Future offerings



Bent WWF



Drop Panel



Drain WWF



**Open loop Stirrup Cage
for Beam**



Column Link Cage

Applications of Welded Wire Fabric (WWF)

Housing & Commercial



Building -Slabs



With modern
formwork –Walls

Industrial



Flooring

Precast



Infrastructure



Highways & Bridges Pavements



Tunnel Guniting



Slope Guniting



Gabions –
Stone walls



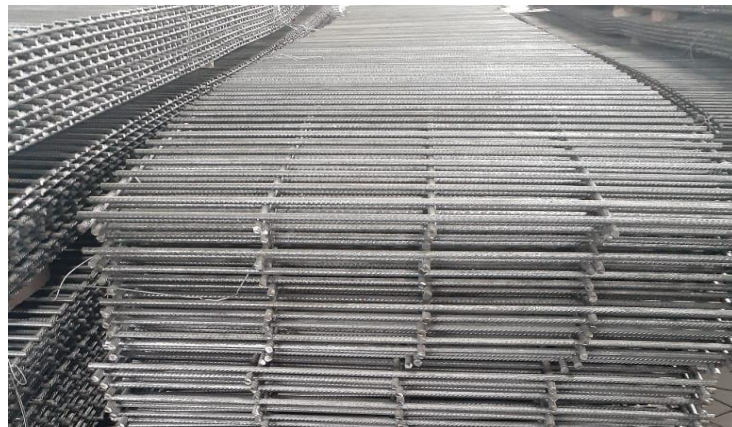
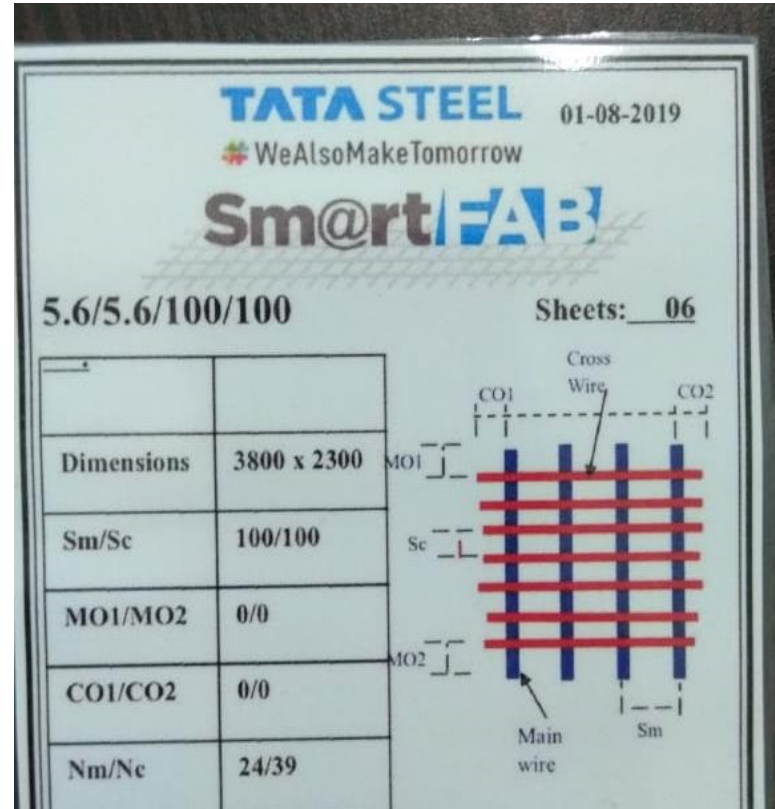
Canal - Lining



Side walk



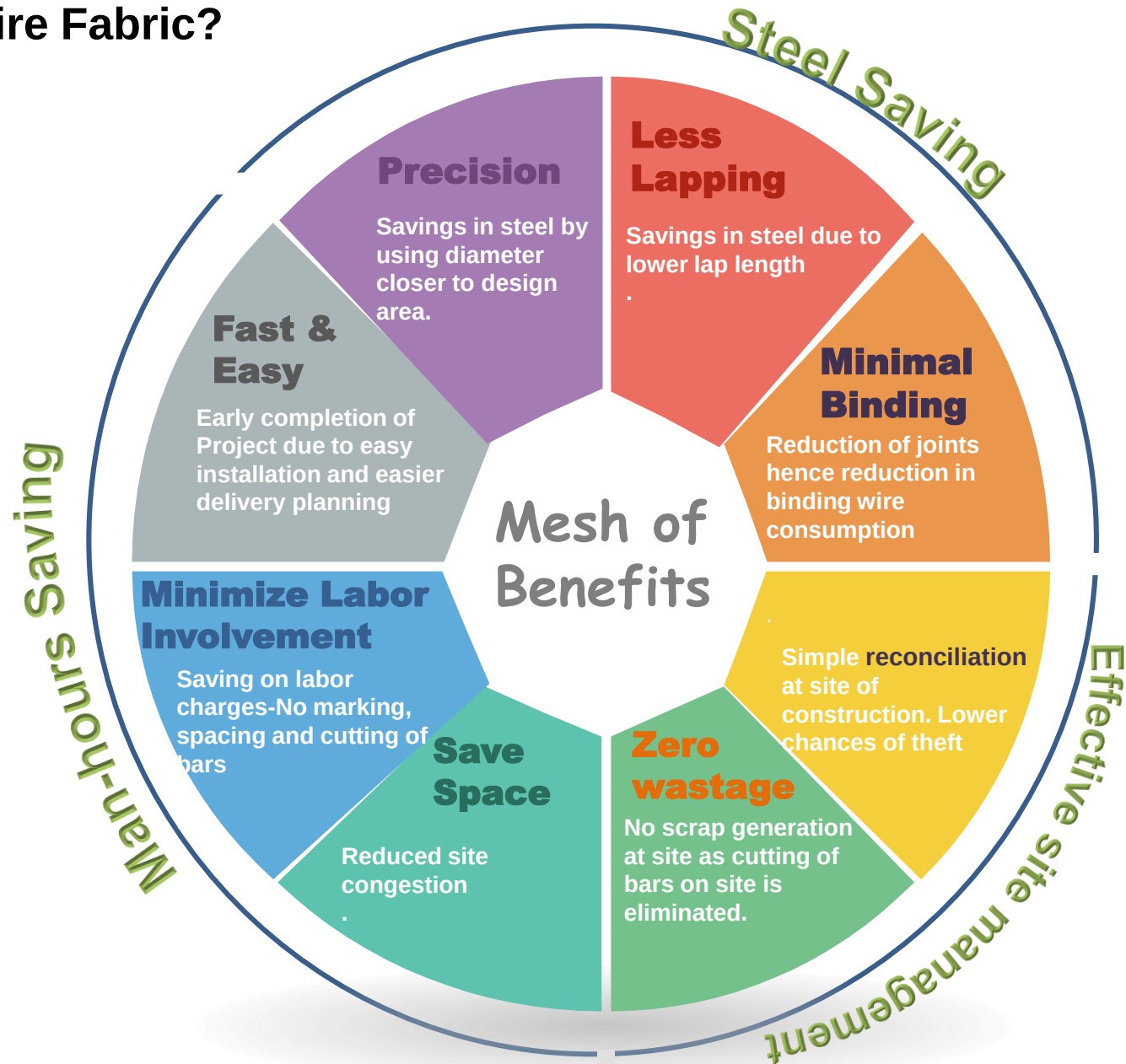
Metros – Higher dia
F- WWF or Carpet
reinforcement

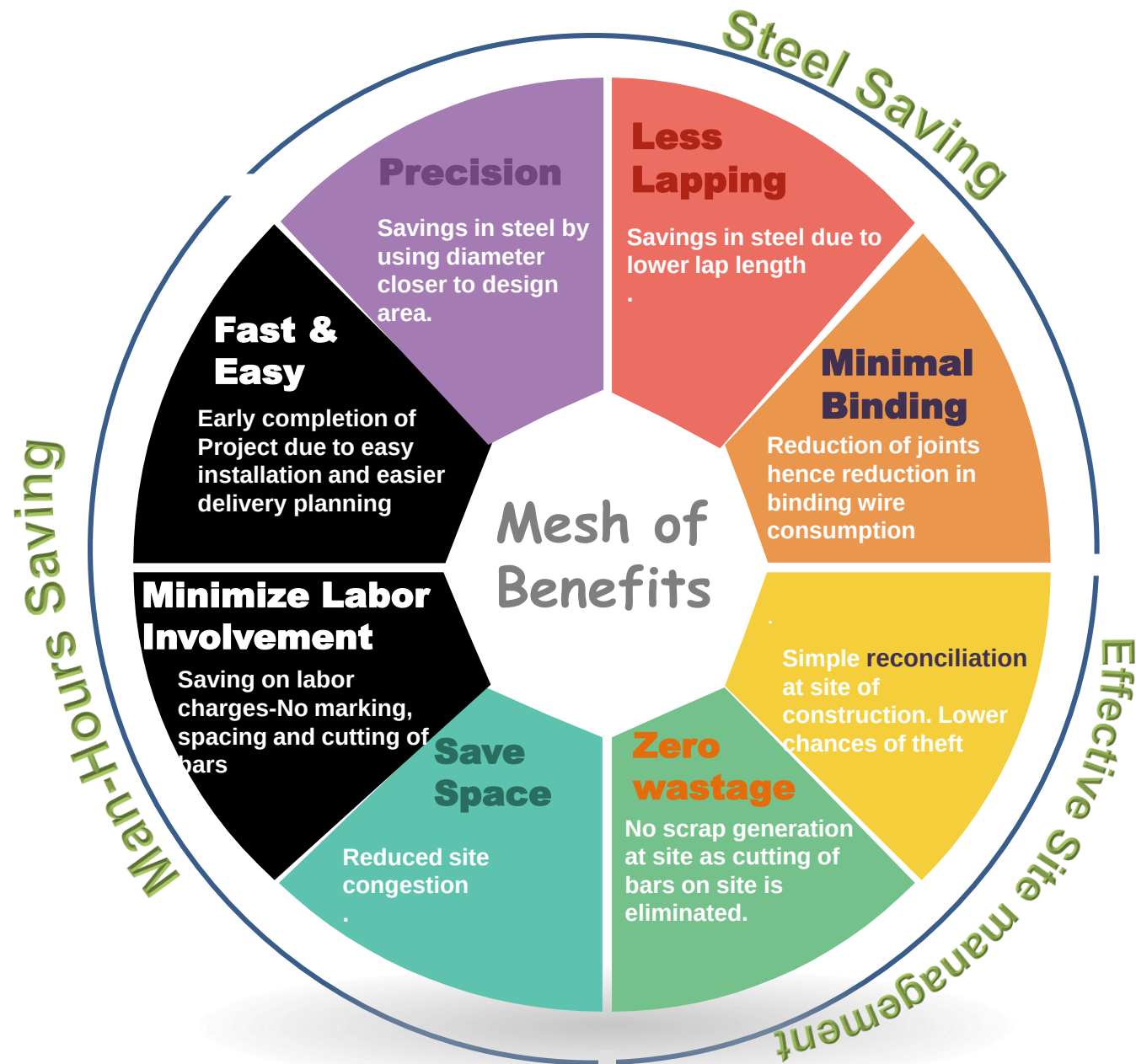


Sm@rtFAB Weldmesh Supply



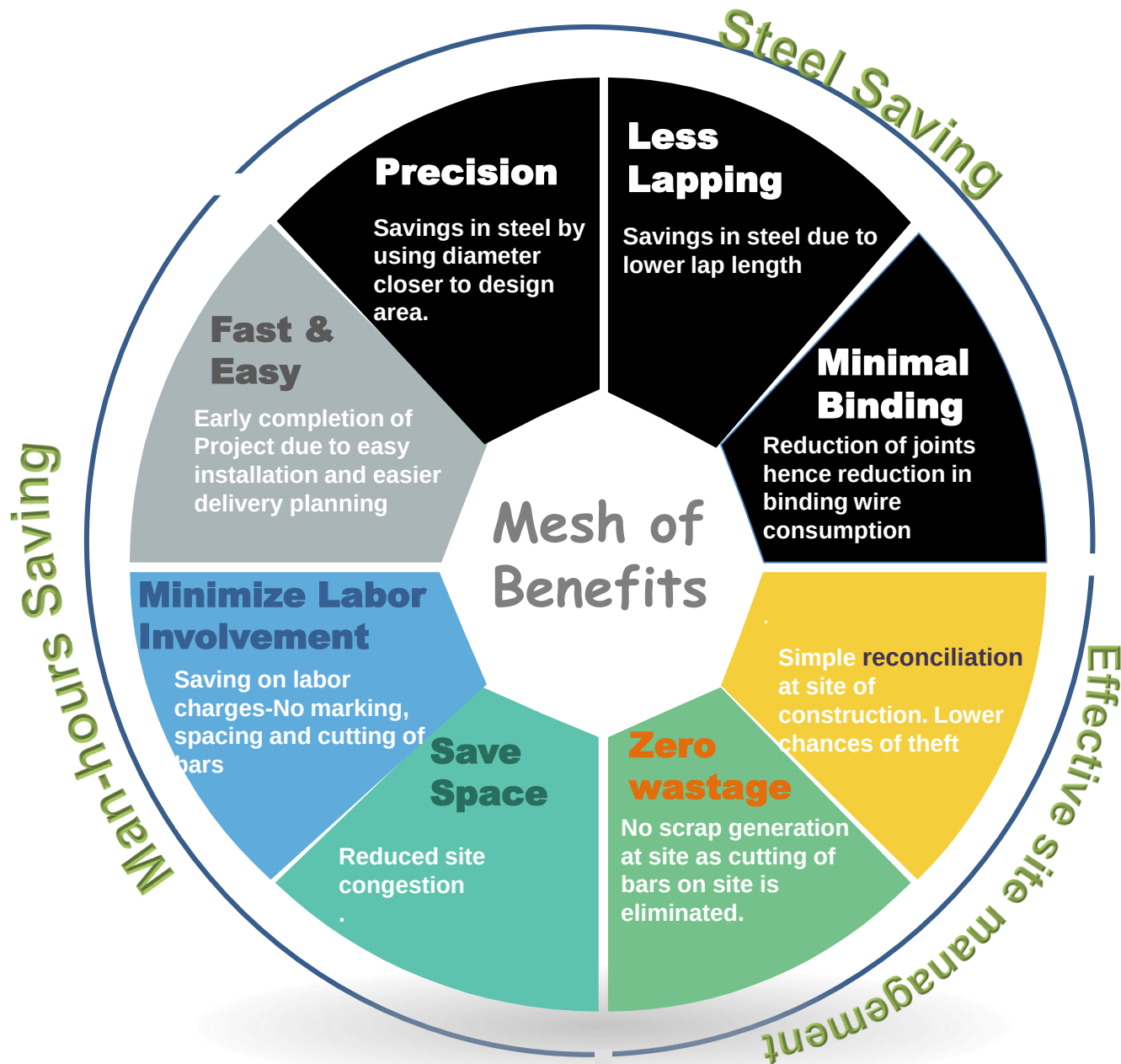
Why use Welded Wire Fabric?





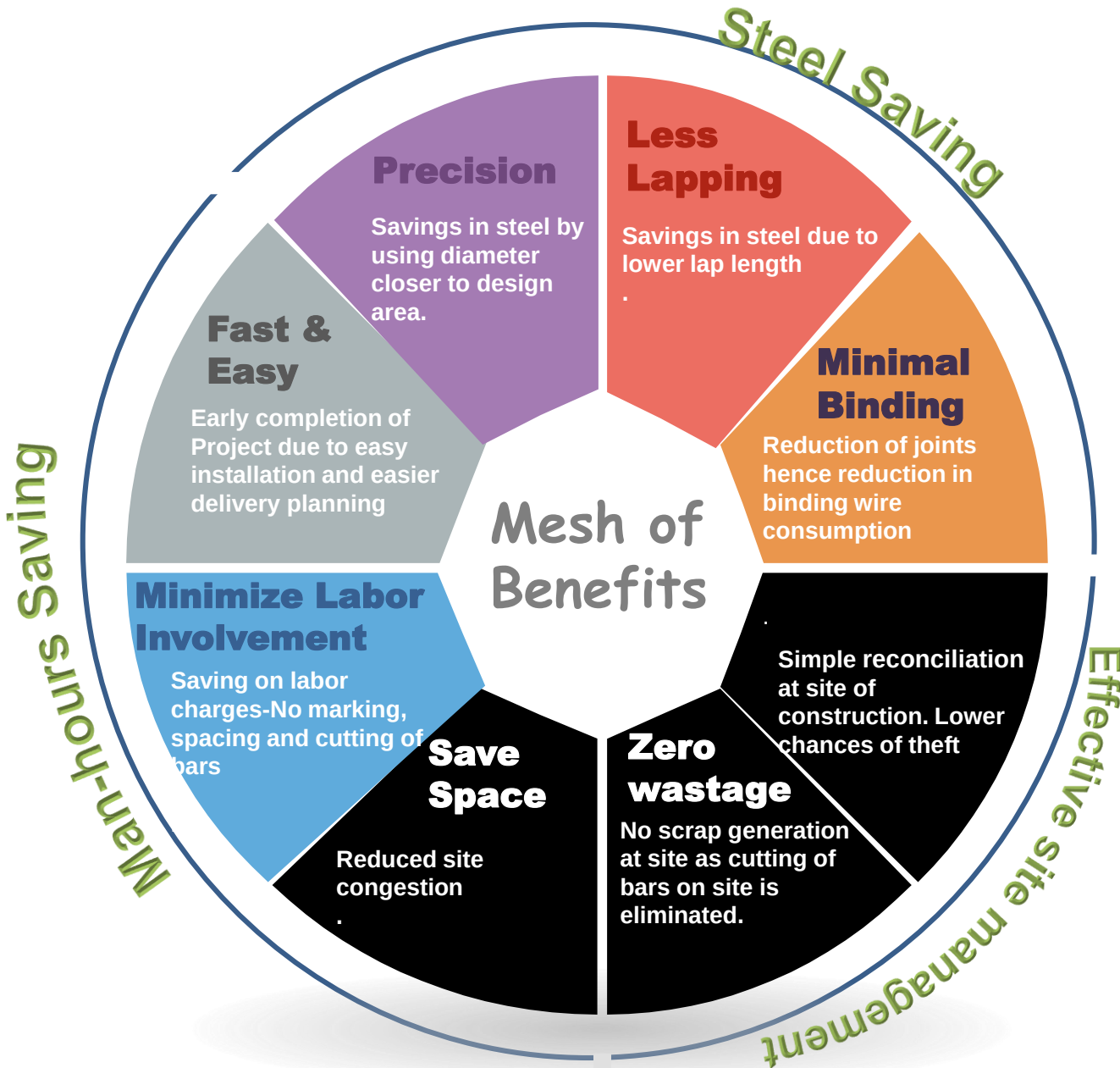
Man – Hours Savings :

- Lesser number of labors needed as no marking, spacing and cutting of bars at site
- Prefabricated mesh is delivered to site as per design leading to early completion of reinforcement work



Steel Savings:

- Saving in steel by using diameter closer to design area can be up to 40%
- As per IS 456, Lapping length requirement is just spacing +100 mm, compared to ~50D in rebar reinforcements
- Savings because of lesser consumption of binding wire



Effective site management:

- Reconciliation at site of construction becomes easier
- Zero wastage as cutting of bar is eliminated
- Stocking at site becomes simpler
- Reduced pilferage
- Easier inspection

Adoption of new construction technologies and Government regulations are expected to drive demand for WWF.



New construction technologies

- Modern formwork technologies ,
- “pre-cast” panels,
- Steel structure building with decking and thin concrete cover.



Govt. Policies to speed up Housing segment :

- RERA
- Mass Housing – Smart Cities ; Pradhan Mantri Awas Yojna ; Public Private People Participation (PPPP) projects - ex -Tata Housing projects



Indian Standards code leading to Steel Savings when WWF is used:

Minimum steel requirement length requirement where load is less.
Meeting closer to design requirement .
Lower lap .

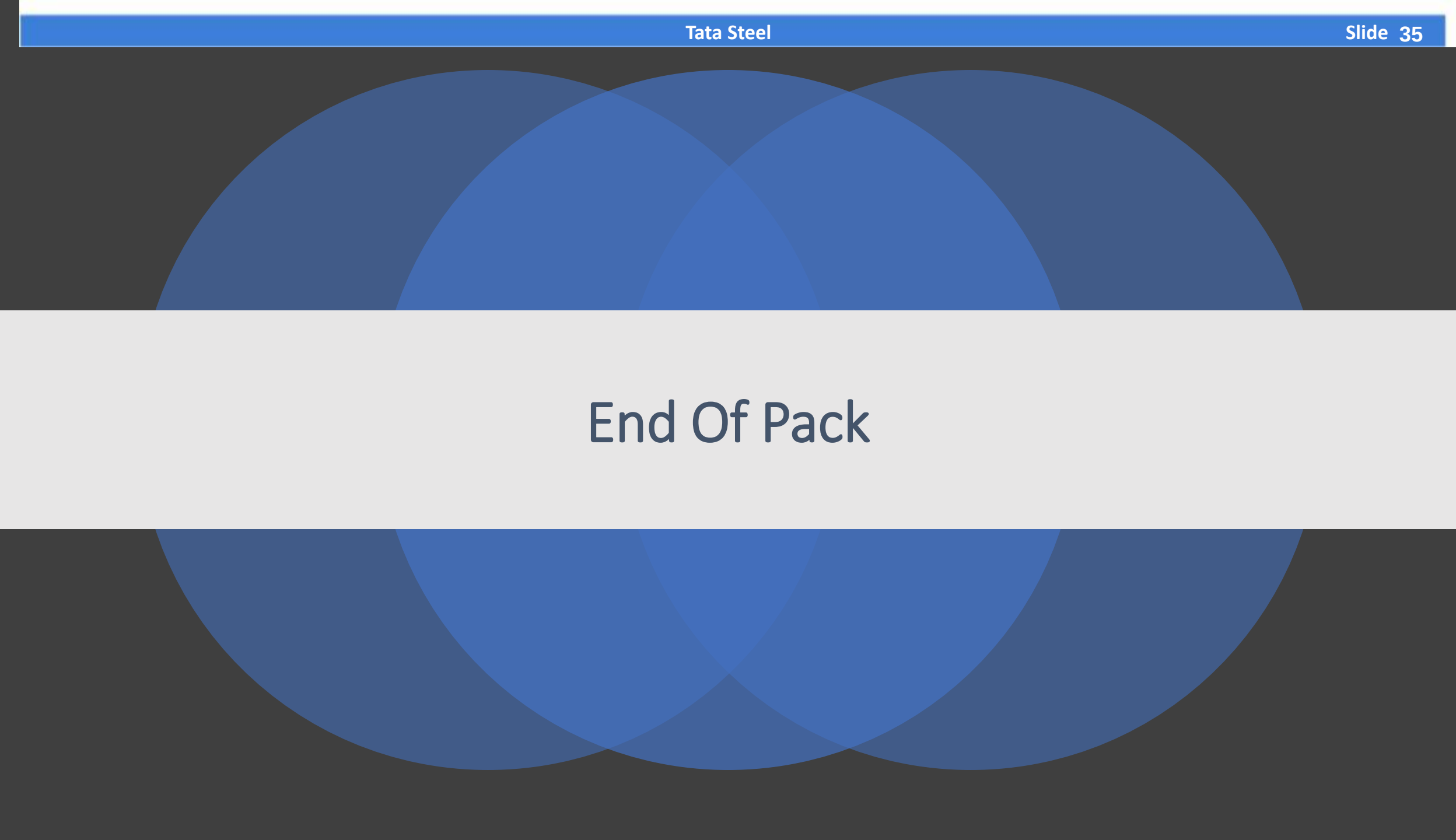
Physical and chemical properties of WWF - determined based on IS specifications

Desired Physical Property	Unit	Min Value as per IS 432-2	Achieved 550 Gr properties
UTS	N/mm2	570	585
Proof Stress (0.2%)	N/mm2	480	550
Elongation over gauge length 8D	%	7 1/2	10
Shear strength	0.25 times of Ys => as per IS 1566 with test method of IS 4948.		

Desired Chemical composition -%	C	Mn	P	S
Min	0.03	0.30		
Max	0.13	0.60	0.05	0.05

Unique Services offered by Tata Steel along with the product

- Design consultancy through dedicated structural consultants
- Supply chain solution from wire rod to mesh at site (Fragmented supply exists in the industry)
- Certified test reports of Mesh from accredited labs (Not a prevalent practice in industry)
- Mesh detailing services through TSL IT infrastructure
- After sales support e.g. Placement drawing services



End Of Pack