CASE STUDY 2:

Value Chain Integration Through Fabrication

[REBAR]

From VDC to IDD through Fabrication Value Chain Integration

"Build Twice"

first **Virtual,** and then **Real**

DESIGN → CONSTRUCTION → **VDC**

VDC primarily focuses on the integration between design and construction.

FABRICATION is a key link to move from VDC to IDD as it integrate both upstream design requirements and downstream site activities as a connected value chain.

- Standardized design incorporating fabrication requirements
- Accurate fabrication detailing & coordination
- Digital procurement
- Production Management
- Delivery & component tracking
- Progress update and claims

DESIGN | FABRICATION | CONSTRUCTION | FM → **IDD**

- Early involvement of fabricator
- Handover of BIM data for fabrication
- BIM to fabrication automation
- Yard quality Inspection
- Site quality Inspection
- Defects Inspection

Current Gaps and Desired Outcomes

Paper-based, manual, and fragmented processes

[GAPS]

Inadequate information required for fabrication

Manual & inefficient ordering system

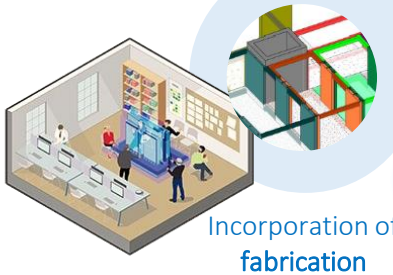
BIM not fully utilized throughout fabrication supply chain

Delays & errors in **production and delivery**

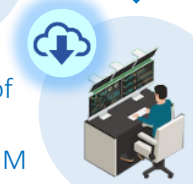
Manual delivery tracking and update

DESIGN | FABRICATION | CONSTRUCTION | FM

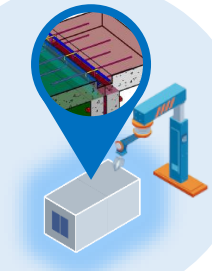
[DESIRED OUCOMES]



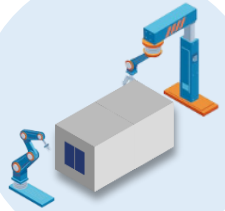
Incorporation of **fabrication information** in BIM model



Digital **ordering & procurement**



BIM-based **automated fabrication**



Timely, cost effective, productive **production** and **delivery**

real-time **status monitoring** and cost management

Efficient, connected, and digitalized processes with improved data flow and transparency

IDD Framework for Rebar Value Chain

The following outlines how the IDD Framework is utilized to achieve **REBAR Value Chain Integration.**
The same concepts or components may also be relevant for other fabrication trades.

KPIS
Challenge Statement

- Eliminate **paperwork** and **manual re-entry**
- Enable **smooth flow of digital information** and **stakeholder connectivity**
- Facilitate fabrication **automation**
- Timely, cost effective, productive **fabrication** and **delivery**

PROCESS
Processes to streamline for better integration

- **Rebar ordering** / procurement
- **Component tracking** and **status monitoring**

INFORMATION
Standardized Information Requirements

- **Rebar Database** standards
- **BIM to machinery** data standard (bvbs)
- **Purchase Order** (PO) **Delivery Order** (DO) standards
- **Component** mark and tag

TECHNOLOGY
Innovative & customized use of technology

- Rebar BIM **detailing tool** and data extraction **plugin**
- **Rebar digital ordering platform**
- Back end systems / **ERP**
- **Production automation** (robotics)

KPIs

DELIVERY TIMELINESS [DIFOT]
xx% Delivery-in-full-On-Time [required delivery date / actual date]

PRODUCTION MONITORING
xx% productivity improvement in tracking and monitoring fabrication progress

BBS PREPARATION
xx% reduction in man-hrs in preparing BBS by main contractor

ORDER PREPARATION
xx% reduction in man-hrs in keying order details by rebar supplier

FABRICATION SHOP DWG PRODUCTION
xx% reduction in man-hrs in producing fabrication shop drawings

Streamlined Processes

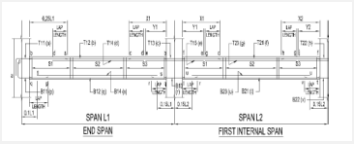
[CURRENT]

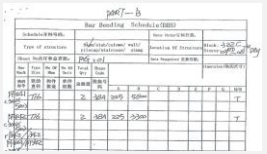
REBAR SUBCON

MAIN CON

REBAR SUPPLIER

REBAR PROCUREMENT & TRACKING





Study 2D drawings

- Manual, 2D

Rebar detailing

- Manual entry
- Rebar limitation not picked up

Create BBS

DESIGN DWG

BBS

Prep Job Advice

- Manual entry

JOB ADVICE

- Fax

BBS

Review Order

- Manual entry for order details

Planning

- Manual re-entry for BBS details

Production

- Communication breakdown from what is expected vs what is actually produced
- Manual monitoring

Status Update

- Manual order tracking

Prep DO

- Manual entry

Verify

DELIVERY ORDER

Received on site

- Wrong components delivered
- Delayed delivery

The current process of rebar procurement and status tracking is predominantly manual, paper-based and fragmented, resulting to duplicate work (e.g. data re-entry) and errors in production and delivery.

Streamlined Processes

[NEW]

Fabrication

Construction

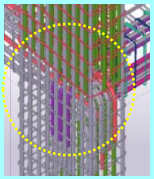
REBAR PROCUREMENT & TRACKING

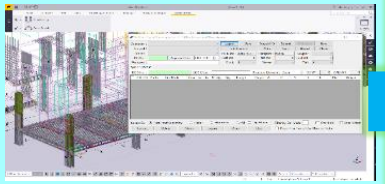
MAIN CONTRACTOR

REBAR SUPPLIER

TEKLA

Order Submission Plugin





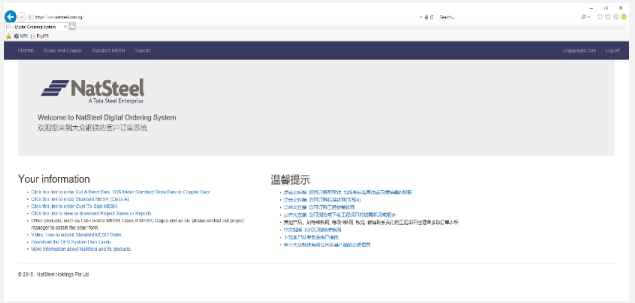
Select Rebar elements

BBS auto generated

BBS

Create Job Advice

Natsteel Digital Ordering System



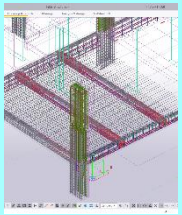
JOB ADVICE

BBS

REBAR MODEL

TEKLA

Rebar detailing tool



Model Rebar

In the new process, most of the data required for downstream planning and production is auto-generated from the rebar BIM model, produced either by the main contractor or the rebar supplier.

The main contractor then submits their rebar order via an order submission plug-in and is received by the supplier's cloud-based platform which connects the data to their own back-end processes.

BACKEND SYSTEM

Review Order

Planning

TAG

Production

Status Update

prep DO

Verify

required date

DIFOT [Delivery-In-Full-On-Time] = xx%

actual date

DELIVERY ORDER

Received on site

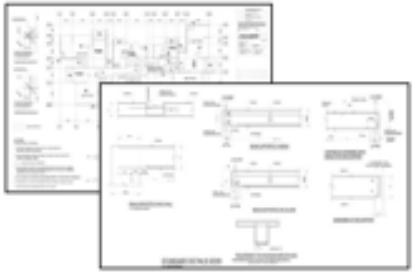
Information Standards

[CURRENT]

[NEW]

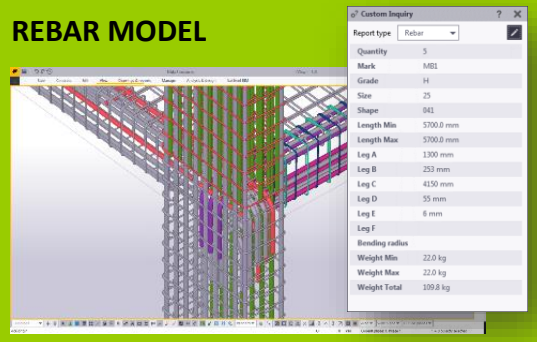
FABRICATION DWGS / MODEL

Manually review construction drawings to prepare fabrication drawings



- Structural Plans
- Rebar schedule
- Rebar details
- General notes
- Standards
- Typical details

REBAR MODEL

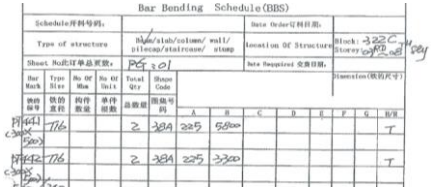


Use of supplier's rebar database [BS 8666]

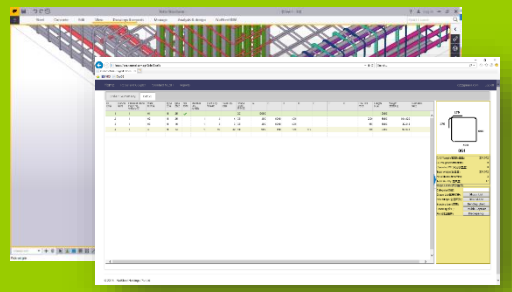
- Quantity
- Mark
- Grade
- Size/diameter
- Shape
- Length/dimensions

BAR BENDING SCHEDULE [BBS]

Manually calculated BBS



- Customer Details
- Project Details
- Purchase Order Number
- Required date
- Work Breakdown Structure (WBS)
- BBS Number



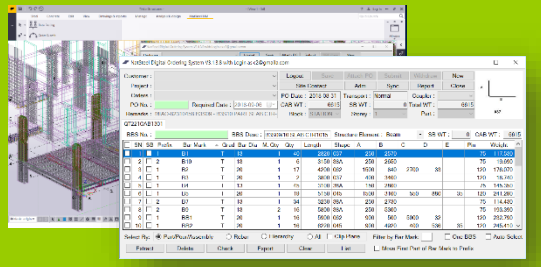
Auto extraction of BBS data:

- *Type of structure*
- *Bar mark*
- *Type size*
- *Quantity*
- *Shape code*

JOB ADVICE / PURCHASE ORDER

Manually filled in form

- Customer Details
- Project Details
- BBS Number
- PO Number
- required date
- Work Breakdown Structure (WBS)
- BBS as an attachment to the Job Advice



Digital data entry and submission:

- *Customer Details*
- *Project Details*
- *BBS Number*
- Purchase Order Number
- Required date
- Work Breakdown Structure (WBS)

** Automatic entry*

Information Standards

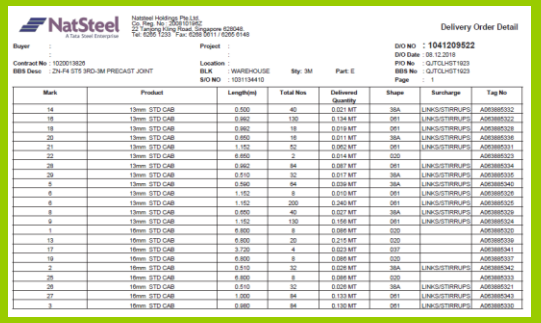
[CURRENT]

[NEW]

DELIVERY ORDER

Manually filled in form

- Customer Details
- Project Details
- Contract Details
- PO Number
- DO number
- BBS Number
- Product Details
- Surcharges (if any)
- Trailer details


NatSteel
A Tata Steel Enterprise

Delivery Order Detail

Mark	Product	Length(m)	Total Nos	Delivered Quantity	Shape	Surcharge	Tag No
14	13mm STD CAB	0.500	40	0.021 MT	38A	LINKS/STIRRUPS	A063665332
18	13mm STD CAB	0.992	139	0.134 MT	061	LINKS/STIRRUPS	A063665322
18	13mm STD CAB	0.992	18	0.018 MT	061	LINKS/STIRRUPS	A063665328
20	13mm STD CAB	0.650	16	0.011 MT	38A	LINKS/STIRRUPS	A063665336
21	13mm STD CAB	1.152	52	0.062 MT	061	LINKS/STIRRUPS	A063665331
22	13mm STD CAB	6.650	2	0.014 MT	020		A063665323
28	13mm STD CAB	0.992	84	0.087 MT	061	LINKS/STIRRUPS	A063665334
29	13mm STD CAB	0.510	32	0.017 MT	38A	LINKS/STIRRUPS	A063665335
5	13mm STD CAB	0.590	64	0.039 MT	38A	LINKS/STIRRUPS	A063665340
6	13mm STD CAB	1.152	8	0.010 MT	061	LINKS/STIRRUPS	A063665326
6	13mm STD CAB	1.152	200	0.240 MT	061	LINKS/STIRRUPS	A063665325
8	13mm STD CAB	0.650	40	0.027 MT	38A	LINKS/STIRRUPS	A063665329
9	13mm STD CAB	1.152	130	0.156 MT	061	LINKS/STIRRUPS	A063665324
1	16mm STD CAB	6.650	8	0.068 MT	020		A063665320
13	16mm STD CAB	6.650	20	0.215 MT	020		A063665339
17	16mm STD CAB	3.720	4	0.023 MT	037		A063665341
19	16mm STD CAB	6.650	8	0.068 MT	020		A063665337
2	16mm STD CAB	0.510	32	0.026 MT	38A	LINKS/STIRRUPS	A063665342
25	16mm STD CAB	6.650	8	0.068 MT	020		A063665333
26	16mm STD CAB	0.510	32	0.026 MT	38A	LINKS/STIRRUPS	A063665321
27	16mm STD CAB	1.000	84	0.133 MT	061	LINKS/STIRRUPS	A063665343
3	16mm STD CAB	0.980	84	0.130 MT	061	LINKS/STIRRUPS	A063665330

Digital data entry through system

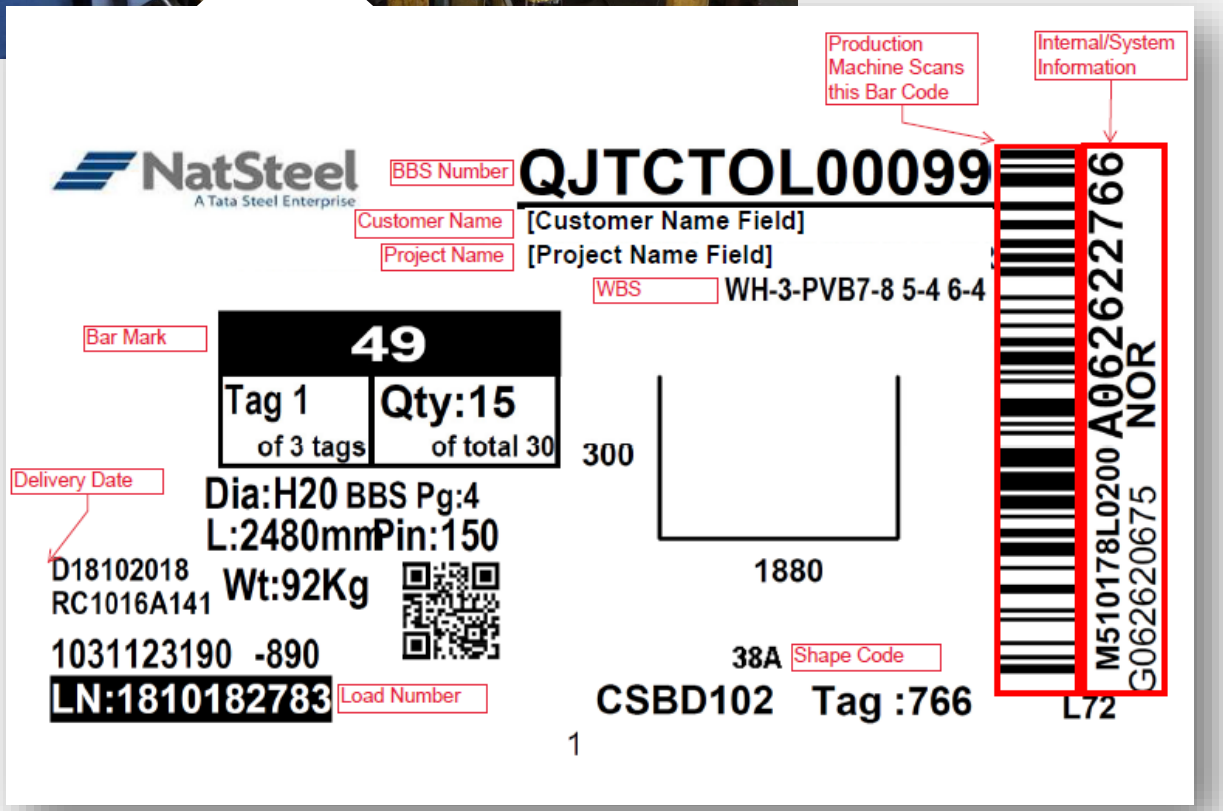
- *Customer Details*
- *Project Details*
- *Contract Details*
- *PO Number*
- *DO number*
- BBS Number
- Product Details
- Surcharges (if any)
- Trailer details

** Automatic entry*

COMPONENT TAG

Component tag is scanned and read by Cut-And-Bend machine to automate production.

The same tag is also scanned to update production status into backend systems.



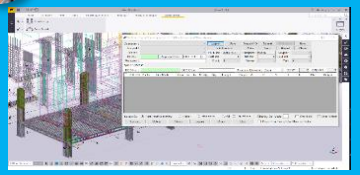
Technology

[SYSTEM ARCHITECTURE]

Relevant information flows from one platform/solution to the next through seamless data integration.

Tekla

Rebar detailing tool



ORDER SUBMISSION PLUGIN

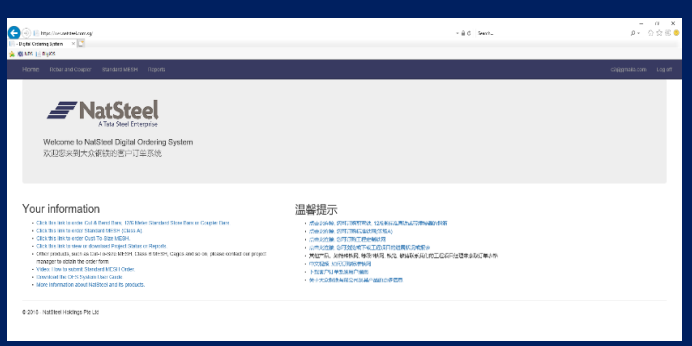
Extracts relevant rebar data from model

JOB ADVICE

BBS

Natsteel Digital Ordering System

Web-based interface to view and manage orders



JOB ADVICE

BBS

SUPPLIER BACKEND SYSTEM

Production Planning Tool

TAG

ERP & MES [production automation system]

Weighbridge Software

Planned vs actual data verification

FABRICATION

DELIVERY

Key Takeaways

Any organization or project team can apply similar concepts of value chain integration for their specific fabrication trade by considering the following:

DESIGN

- ❑ Is my design optimized for off-site production?

- ❑ Is our fabricator BIM or digitally ready?
- ❑ Can we involve them earlier?
- ❑ Have we incorporated fabrication considerations in design and construction coordination?
- ❑ Can we streamline the process of fabrication drawing approvals?

FABRICATION

- ❑ Can I digitalise any of our manual processes and forms? (e.g. PO, DO)
- ❑ Can I streamline and standardize some of these information requirements?
- ❑ Can I utilize BIM data for production?
- ❑ Can I link BIM data into my back-end systems / ERP?
- ❑ Can I digitalise my inspections?

CONSTRUCTION

- ❑ Is my actual site schedule synchronized with our production / delivery schedule?

- ❑ Is my site ready to receive off-site components in terms of timeliness of execution and accuracy of as-built?

- ❑ Can we digitally track status of production, delivery, and installation?
- ❑ Can this status be updated back into the BIM model?
- ❑ Can we use this digital status update as basis for progress claims?

FM

- ❑ How can we effectively reduce and manage last minute amendments?
- ❑ How do we ensure smooth flow and update of relevant information among stakeholders? e.g. Construction/design BIM shared to fabricator for further detailing

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