Product Benchmarking

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Methodology:

- Understanding the detailed requirements from the site, (wish list, nearest competitors)
- Preliminary Collection of data from various sources like competitor websites, internet search for the related specifications
- Detailed information gathering by visiting the actual work sites, exhibitions / Expo shows, service stations etc.
- Categorization of data into various buckets.
- Detailed Excel based report starting with co-relation study of various competitors and arriving at the best specifications.
- For components a detailed comparison is made by capturing details like no of bends, weld areas, castings, ease of manufacturability.
- Highlighting the best path for component design to be followed for NPPD

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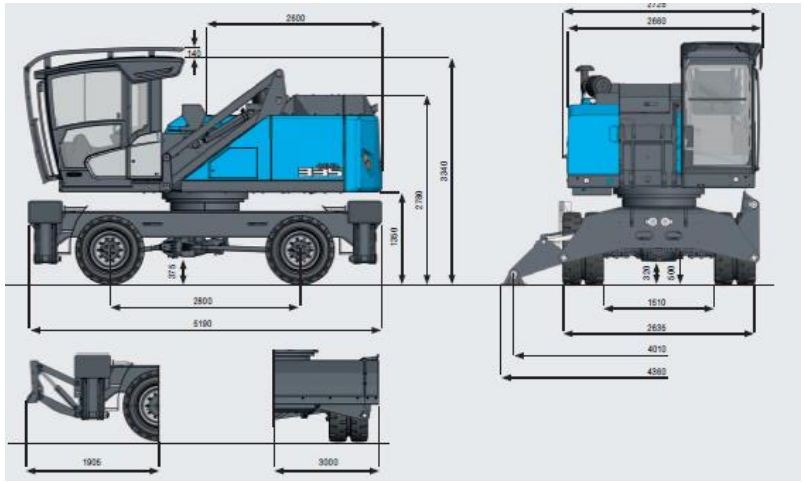

Project Plan

Input Study & Planning

- Gather all technical documents of machines to compare.
- Comparison of specification documents of all machines.
- Identify the sub-systems & parameters to be considered .
- Prepare benchmark execution plan.
- Prepare performance check plan.

Benchmark activity - In Germany

- TIRC Engineers visit to Exhibition / customer site / Fuchs facility.
- Overview of competitor machines / Fuchs machines
- Observation & sub-systems study
- Conduct performance check activities & capture data.

Data analysis & Report generation

- Analysis of all data captured during benchmarking activity.
- Compile the data into measurable outputs.
- Report generation
- Industry trend report
- Best practices
- Unique selling points
- Voice of customer – VOC
- Best machine spec.
- SWOT analysis
- Specification comparison
- Performance check results

Data capturing for Material Handler

- Data Collection from Competitor Machines
- Comparison on Lifting Load, Various Boom & Stick combinations, Attachements and Machine Dimensions.
- Various Operating parameters taken Operating weight, working range, Lifting load,engine and emmission, Travel drive, Swing drive, brake system, structure and Cab.
- Functional Aspects for Hydraulic & Electrical system, Equipment features.
- For Transport condition, Shipping Height with Falling Object Guard, Shipping Length.
- Various Attachments, like Sorting Grapple, Hydraulic Hammer, Pulverizer, Dedicated Quick Coupler, Pin Grabber Coupler etc.

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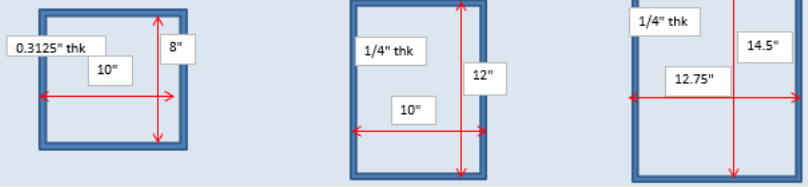
Utilities Transmission TL series Benchmarking.

Observation on TL series Machines	Terex	Versalift		
	TL 60	VST 6000 I03	VST 7500 E108 With elevator lift	VST 9500I
Basket Capacity (lbs)	600	650	800	600
Platform Height (ft)(with 33 ft elevator)	60.1	60	108	95
Hydraulic system pressure (psi)	3000	2250	3000	3000
Dielectric Category	C	B	B	B
Rated line voltage (kV)	46	69	69	70
Travel height (ft)	12.1	12.9	13.5	13.4
Flow rate (gpm)	8.0	7.5	10	10.0
Hyraulic Pump Power (Hp)	14.0	9.8	17.5	17.5
GVWR,Weight Comparison(lbs)	33000	33000	58000	58000
GAWR-Front (lbs)	14000	12000	18000	18000
GAWR-Intermediate1 (lbs)			20000	20000
GAWR-Rear (lbs)	19000	21000	20000	20000
Cycle time				
Rotation (CW or CCW) (seconds)	66-76	55-70	90-105	90-105
Lower boom (Raise)	25-35	35-50	40-50	50-60
Lower boom (lower)	25-30	25-35	30-40	35-45
Upper boom (Raise)	27-37	30-45	40-50	40-50
Upper boom (lower)	24-34	25-35	30-40	30-40
Inner boom (extend)	12-24	18-28	25-30	50-60
Inner boom (retract)	18-28	18-28	20-30	25-35
Outrigger Type	A frame type outrigger on front and back	A frame type at front and different type of outrigger at rear end as shown	Radial type outrigger	Radial type outrigger

Lower Boom-Moment of Inertia

Iyy (inch 4)	160.3	236.0	438.0	438.0
Ixx (inch 4)	113.3	178.3	359.8	359.8



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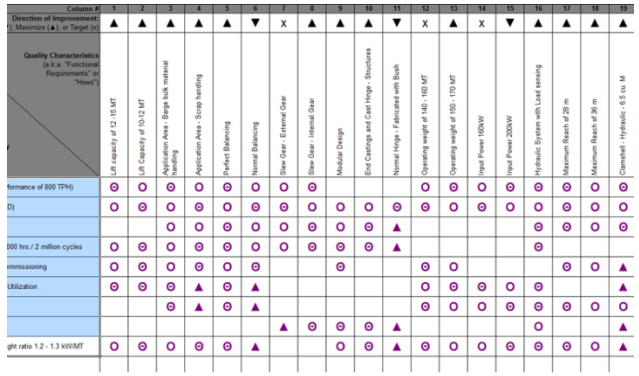
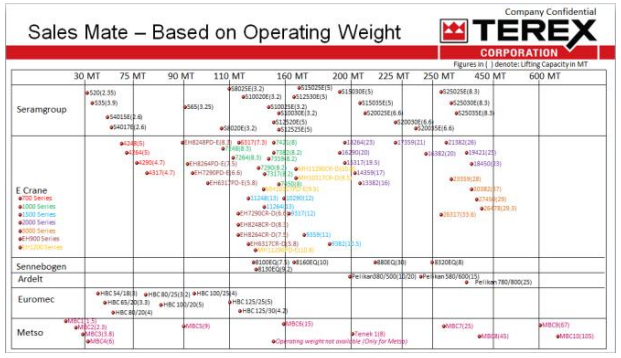


Balance Crane Market Research

- Study & Researching of Major Manufacturers of Balance cranes on:
  - Market Share
  - Sales Based on Geographies
  - Statistics
- SWOT Analysis of competitor products.
- Feature Comparison for Application Type, Size of Balance Crane, Type of Mount, Input Drive, Balancing Mechanism, Counterweight, Type of End Attachment, Cycle Times.
- Provided Design Observations on the components & subsystems.
- Arriving at Preferred New Product Spec & features – Options & Pricing.
- Quality Function Deployment- House of Quality to arrive at most critical parameters.



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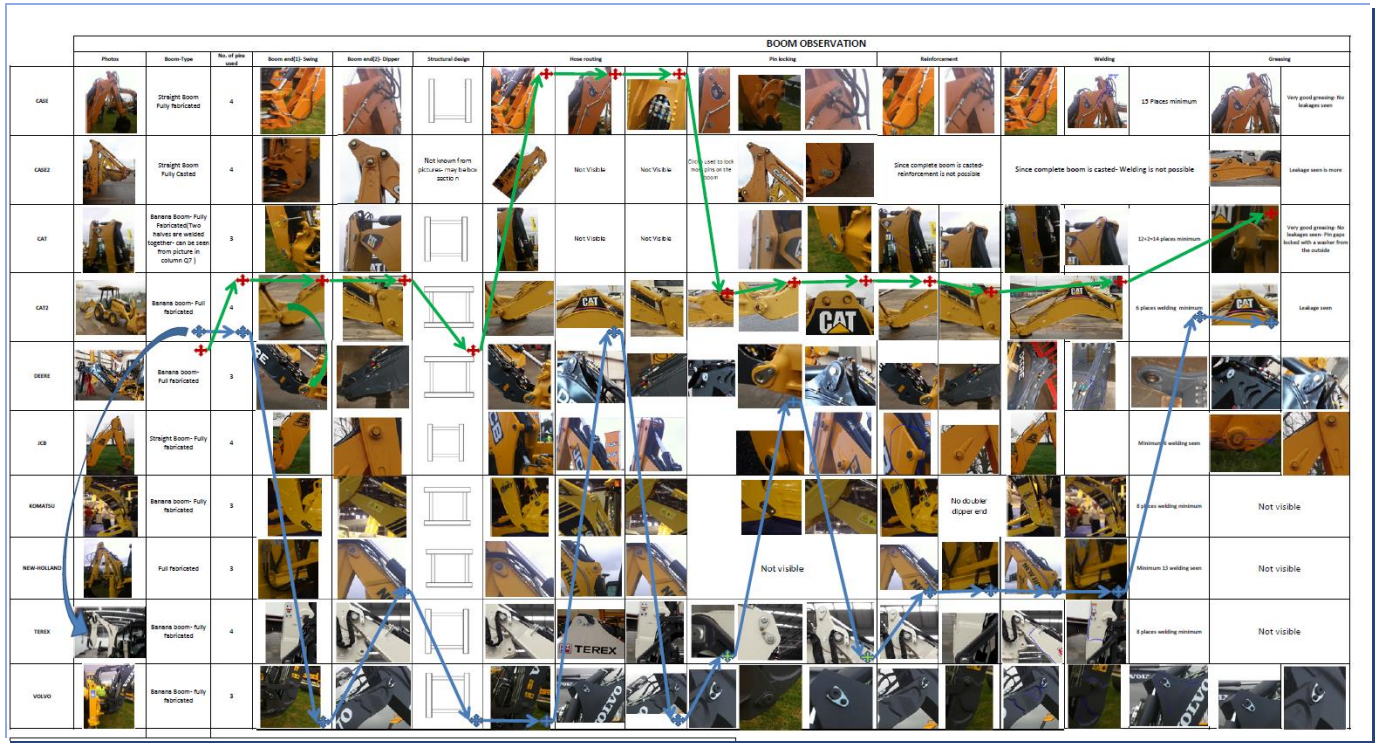

CAT 424B | CASE 770 | JCB 3DX

Product: Backhoe Loader

Benchmarking with market leaders, arrive at best kinematic features, compare the structural, electrical and hydraulics

Key parameters for Benchmarking:

- Structural details
- Kinematic parameters like Dumping height , Vertical wall reach, Digging depth etc.
- Productivity trials of Excavator and Loader group
- Driveline arrangement

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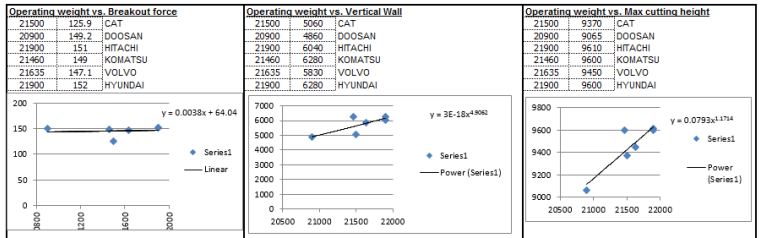
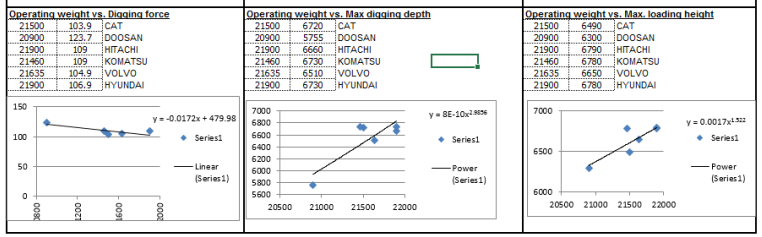
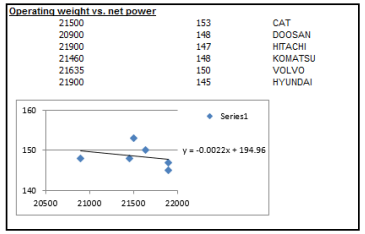
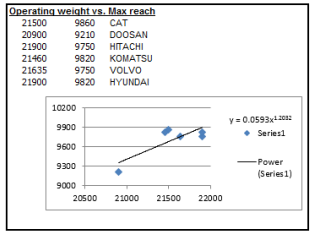
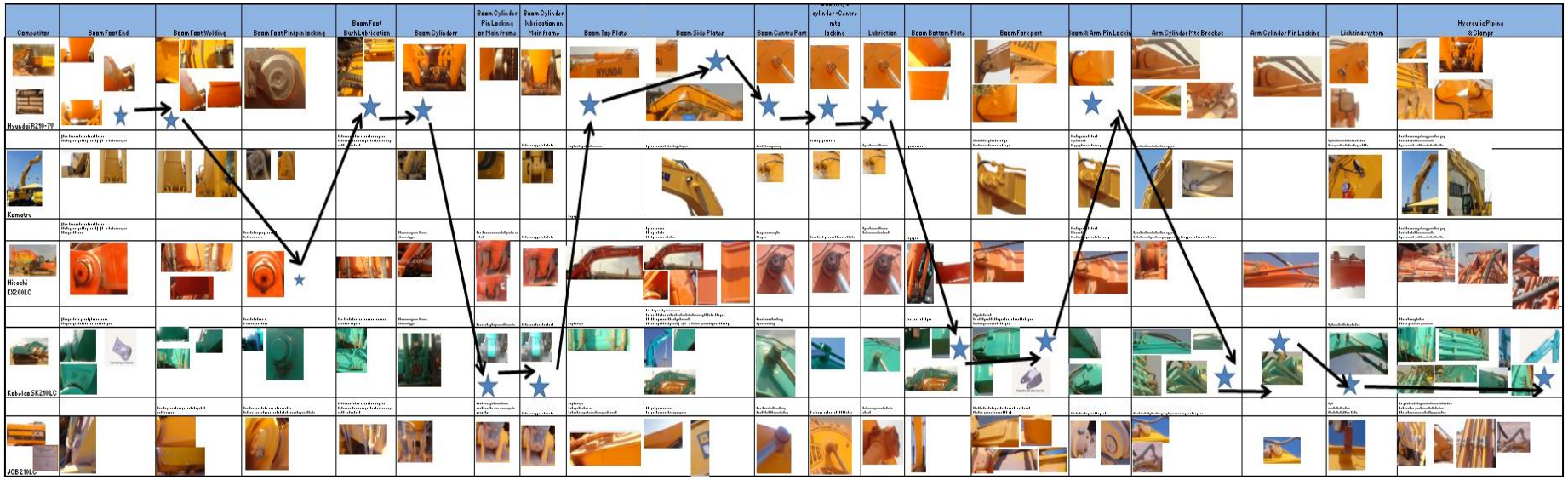


Parameter	Collected Governing Equations	Recommended TVER Specification	UNIT	Machine Operating weight
Breakout Force	y = 0.0038x + 64.04	144	kN	21000
Digging Force	y = -0.0168x + 479.98	109	kN	
Max. Digging reach @ground	y = 0.0585x1.2032	9758	mm	
Max. Digging depth	y = 8E-10x2.8856	6608	mm	
Max. Cutting height	y = 0.0793x1.1714	9400	mm	
Max. loading height	y = 0.0017x1.8205	6440	mm	
Max. Vertical wall	y = 3E-18x4.925	5808	mm	
Net power	y = -0.0022x + 194.96	148	HP	









Product: Excavator 20T

Benchmarking of 20T & 30T class work group excavators

Key parameters for Benchmarking:

- Structural details
- Kinematic parameters like Dumping height , Vertical wall reach, Digging depth etc.
- Correlation study done based on weight, and the best parameters were specified in the result
- Proposed parameters for new machine being worked out for the next generation machines and kinematic parameters were worked out to realize the proposed parameters.