Concept Selection

MAE 2250

Phases

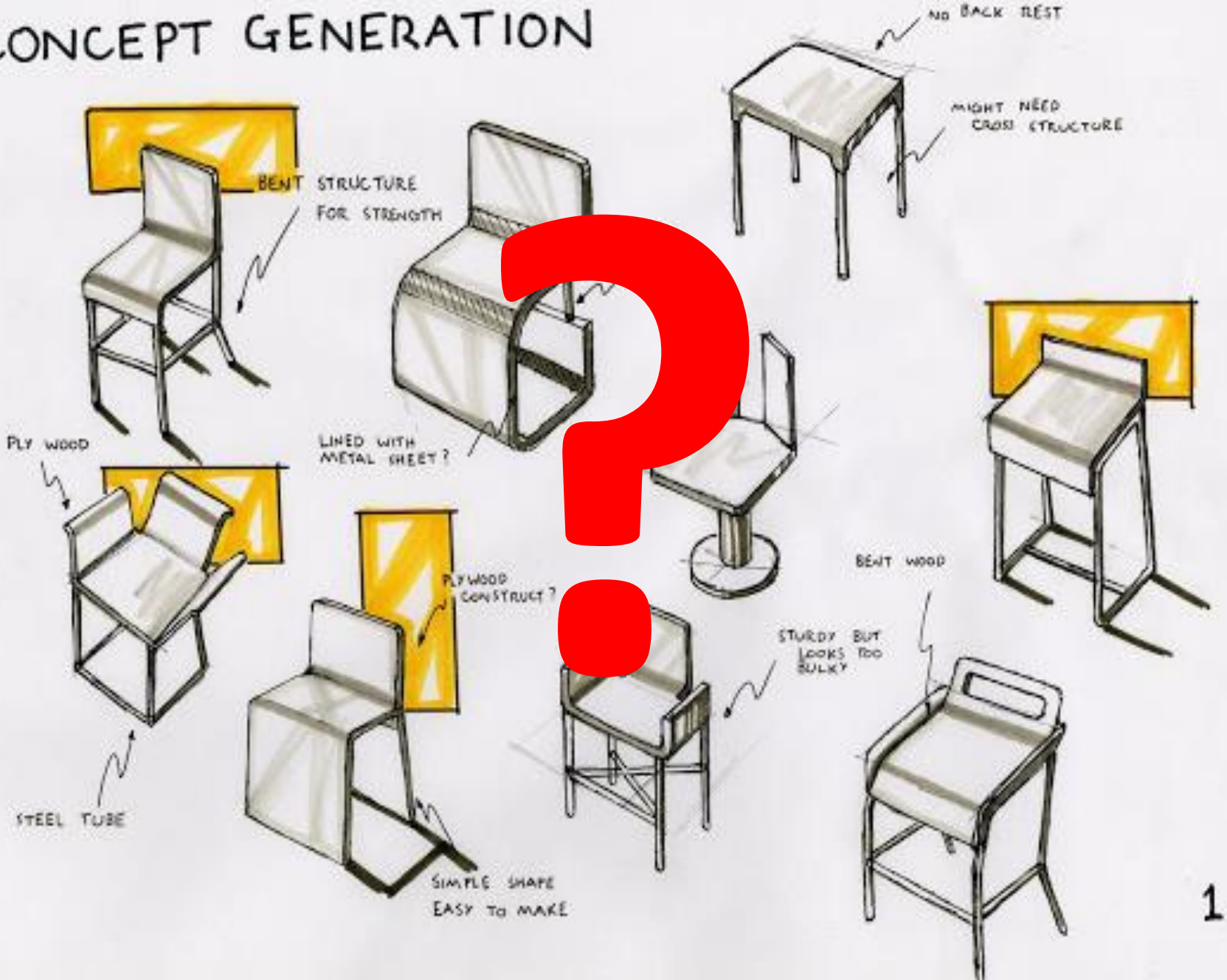
- Phase 0: Planning
- Phase 1: Conceptual design
- Phase 2: System design
- Phase 3: Detail design
- Phase 4: Testing and refinement
- Phase 5: Production ramp-up

Iterate

Needs drive concept generation

- Identify needs
- Establish target specifications
- Generate concepts
- Select concept(s)
- Test concepts
- Refine specs
- Plan project (downstream activities)

CONCEPT GENERATION



Possible Decision Processes

- **External decision**: concepts are turned over to customer or management
- **Product champion**: An influential member chooses a concept according to personal preferences
- Intuition: A concept is chosen by gut feeling
- **Multivoting**: Each member votes for several concepts, and the one with majority of votes is selected
- **Pros and cons**: Strengths and weaknesses are listed, and the team makes a decision.
- **Prototype and test**: Build and test samples, make selection upon data
- **Decision matrices**: The team rates each concept against prespecified selection criteria, which may be weighted

Advantages of structured methods

- **A customer-focused product**: Selection criteria ensure decision is based on customer
- **A competitive design**: by including competitor concepts in the decision options, the selected concept will be competitive
- **Better product-process coordination**: A systematic way to include criteria from down the line, such as manufacturing
- **Reduced time to product introduction**: Reduces ambiguity in the decision, and makes communication to management and manufacturing simpler and more straightforward
- **Effective decision making**: Reduces effects of personal factors influencing decision
- **Documentation of the decision process**: Rational of decision is recorded for the future; impact of changes can be assessed.

Pugh Concept Selection (Decision matrix)

From needs

Include internal

Binary / Numeric / Continuous

Rank

Decide

Recombine

Selection Criteria	Concepts						
	A Master Cylinder	B Rubber Brake	C Ratchet	D (Refe Plung	E	F Lever Set	G Dial Screw
Ease of handling	0	0	–			–	–
Ease of use	0	–	–	0	0	+	0
ettings	0	0	+	0	+	0	+
accuracy	0	0	0	0	–	0	0
	0	0	0	0	0	+	0
Ease of manufacture	+	–	–	0	0	–	0
Portability	+	+	0	0	+	0	0
Sum +'s	2	1	1	0	2	2	1
Sum 0's	5	4	3	7	4	3	5
Sum –'s	0	2	3	0	1	2	1
Net Score	2	–1	–2	0	1	0	0
Rank	1	6	7	3	2	3	3
Continue?	Yes	No	No	Combine	Yes	Combine	Revise

Combine and improve concepts

- Identify weak points of good concepts and eliminate them
- Identify good points of weak concepts and reuse them elsewhere
- Identify partially good solutions and recombine them
- Identify transitive dominance

Use weighting

		Concepts							
		A (Reference) Master Cylinder		DF Lever Stop		E Swash Ring		G+ Dial Screw+	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Ease of handling	5%	**3**	0.15	3	0.15	4	0.2	4	0.2
Ease of use	15%	**3**	0.45	4	0.6	4	0.6	3	0.45
Readability of settings	10%	2	0.2	**3**	0.3	5	0.5	5	0.5
Dose metering accuracy	25%	**3**	0.75	3	0.75	2	0.5	3	0.75
Durability	15%	2	0.3	5	0.75	4	0.6	**3**	0.45
Ease of manufacture	20%	**3**	0.6	3	0.6	2	0.4	2	0.4
Portability	10%	**3**	0.3	3	0.3	3	0.3	3	0.3
	Total Score	2.75		3.45		3.10		3.05	
	Rank	4		1		2		3	
	Continue?	No		Develop		No		No	

Iterate

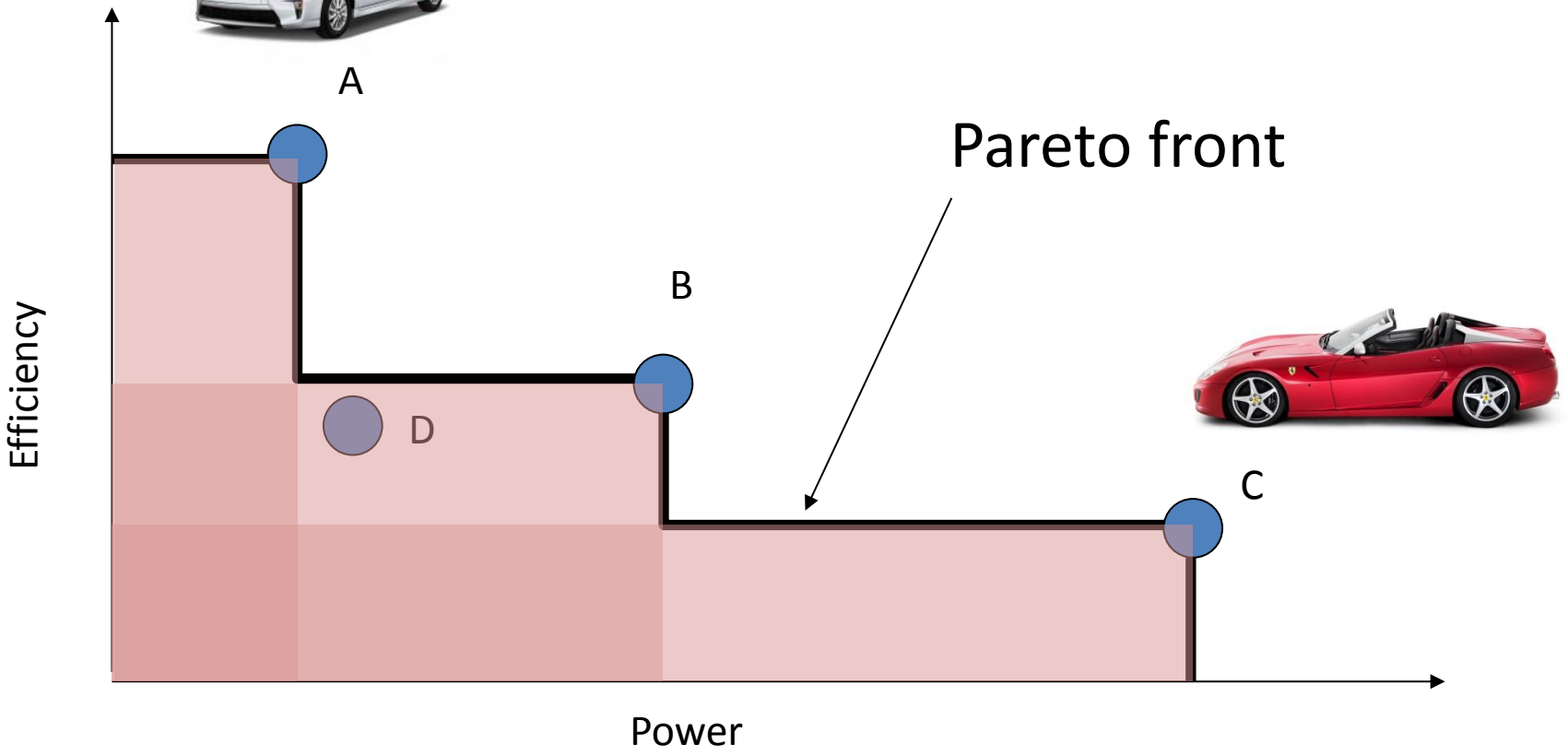
Caveats

- Decomposition quality: Are criteria independent?
- Subjective criteria/weighting

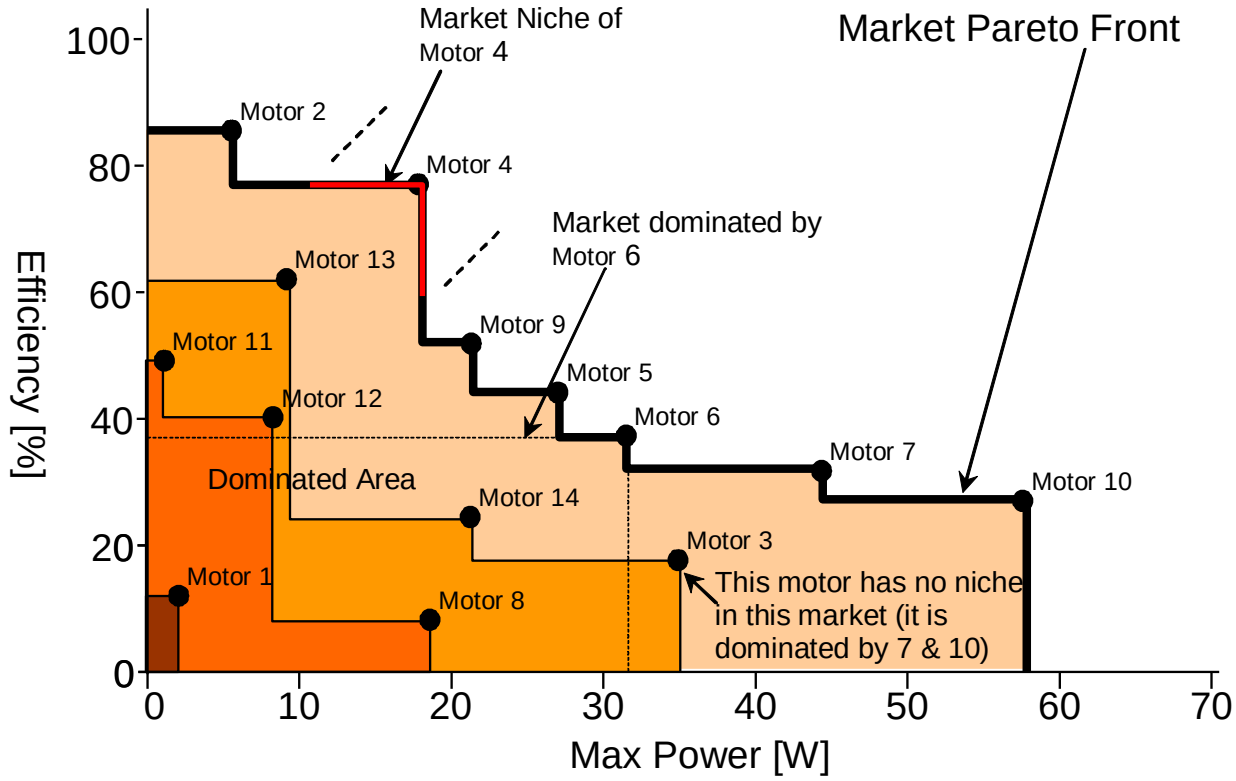
Dominance

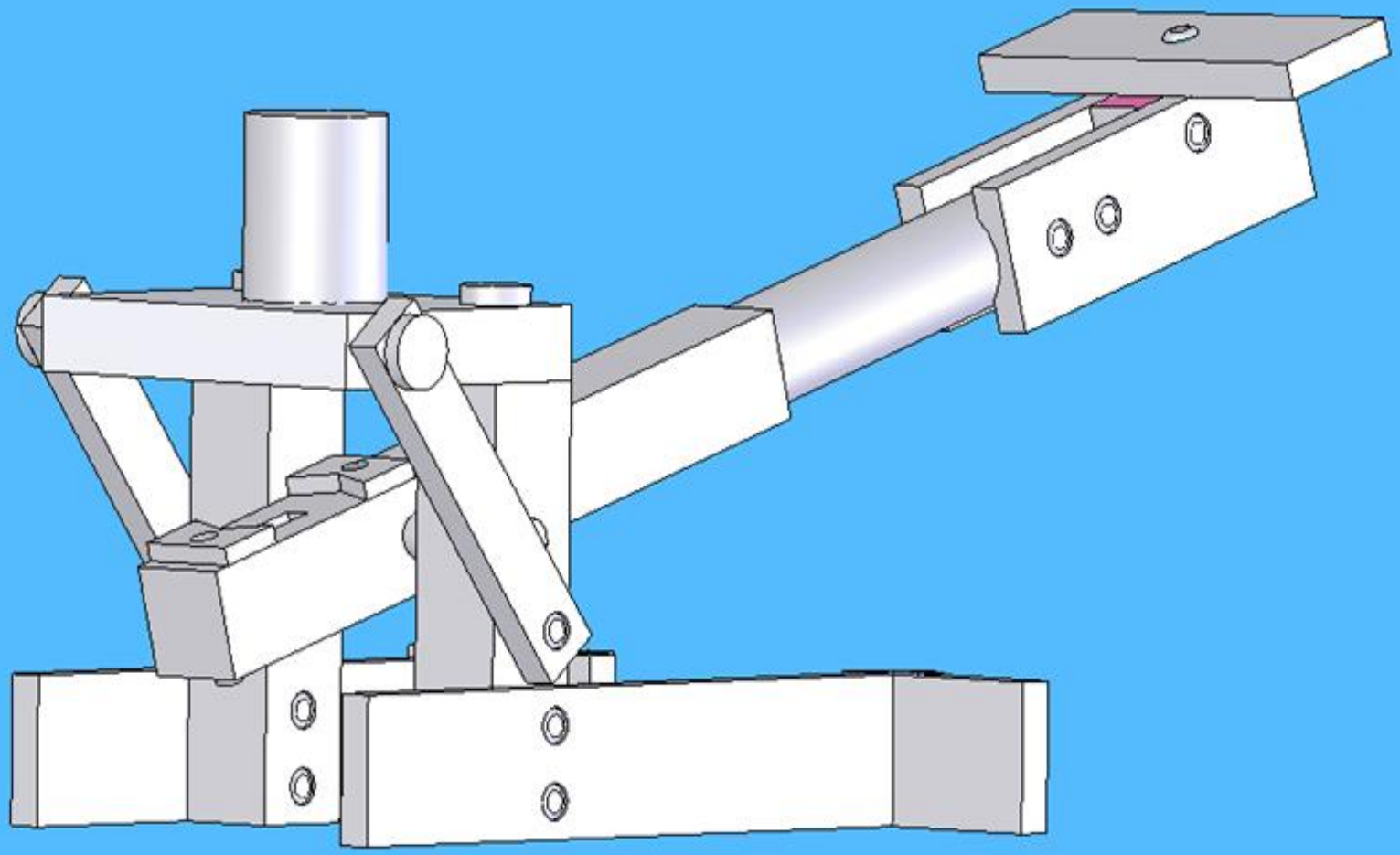
- Identify transitive dominance
- Multiple criteria

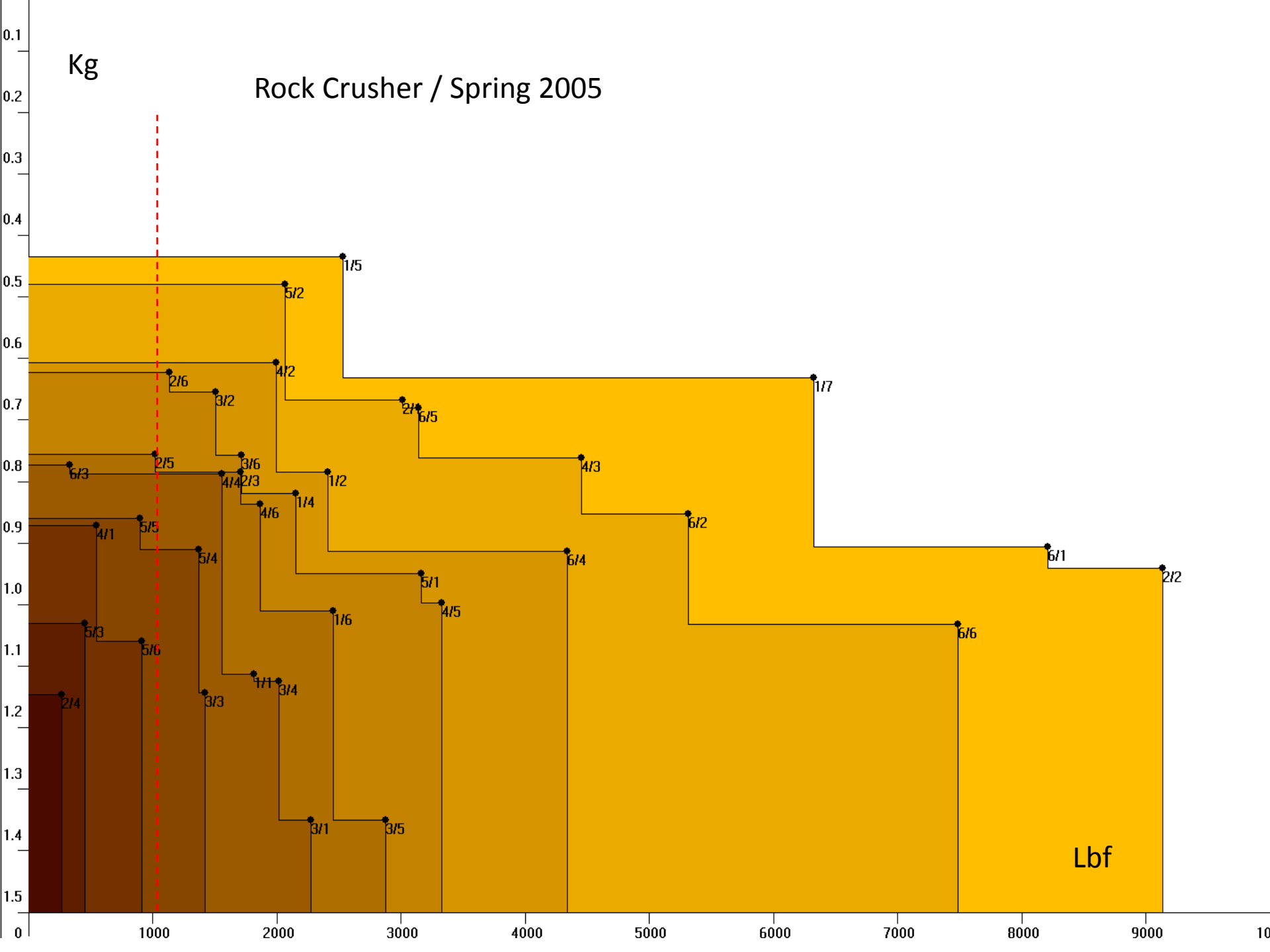
CARS



Multi-objective






Kg
Rock Crusher / Spring 2005
0.1
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2/4
3/3
3/1
3/5
Lbf
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2000
3000
4000
5000
6000
7000
8000
9000
10

CARS