Title: Bill of Material

Theme: cut lists and order lists

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PREREQUISITE ASSUMPTIONS

Before beginning this lesson, students should

- Prerequisite 1: Review textbook information on structural metal and size specifications
- Prerequisite 2: Review the overall format for a print
- ...

Notes to Self

- One thing I want to do during this lesson explain the purpose and function of a material list

- One thing I want to pay attention in my students' thinking is making sure that they understand that the material list is the cut list and what you need to order from a vendor is based on 20 foot lengths of material and taking into account kerf (cut loss)
- One connection or idea I want to remember is to make sure they see the connection between print reading in the classroom and fabrication in the weld lab
- …

Suggested Timeline

Duration	**Activity** (Indicate question number)	**Suggested Structure** (Indicate group, whole class or individual work)
.5 hours	Review structural shapes i.e. angle iron, channel, pipe, round and square tubing, and plate or bar stock.	Whole class-
1.0 hours	Go over 4 material lists from prints in text. How should a material list be set up?	Whole class –
1 hours	Provide students with 2-4 prints to create material lists.	Small group- 2-3 students
.5	Review group assignment for accuracy	Whole class
2 hours	Pretest: Students create a material list from a print and an order list for a vendor	Individual

2 hours	Post Test: Students create a material list from a print and an order list for a vendor	Individual

[Student Handout] see attached file

SPECIFIC OBJECTIVES

By the end of this lesson, you should understand that

- Objective 1: That all Bills of Material must contain a number or letter to represent each item, a quantity, a size, a description of the material and the length.
- Objective 2: That structural metal goes by thickness or metal gage, and then length and width
- Objective 3: That pipe is listed as a nominal size and that the actual OD, ID and wall thickness needs to be looked up in a pipe chart.
- Objective 4: kerf is the amount of metal lost when cutting each piece.
- Objective 5: Most structural metal comes in 20 foot lengths and metal sheets in 48” x 96” or 60”x 120”.

By the end of this lesson, you should be able to

- Objective 1: create a BOM with the necessary components.
- Objective 2: list structural metal in the order format.
- Objective 3: utilize a pipe chart to enter information into a BOM.
- Objective 4: calculate the amount of kerf per structural length or material or sheet.
- Objective 5: figure out how many lengths of structural metal and sheets of metal needed to complete a project according to a print.

PROBLEM SITUATION I : Create a material list to fabricate and an order list for a vendor

Introduction to the problem situation. In order to fabricate a product you must create a Bill of Material which is your cut list. This is the map that you follow. This is to be created before you go to the shear or saw.

In order to order material – you must figure out how the cut pieces will fit into a 20 foot length of material efficiently so there is as little waste as possible. Kerf must be taken into account for saws.

(1) 1st questions: How should a BOM chart be set up? Sample 1

BILL OF MATERIALS

ITEM	Qty	SIZE	DESCRIPTION	Length(ft)
2	1	6	Copy of Trimmed Elbow	
3	1	6	A53 ERW Sch 40 Blk PE	5'-6 1/4"
4	1	1x6	Figure Full Anvilet (Thread O Let)	
5	2	6	Long Radius 90	
6	2	6	150# Raised Face Weld Neck Flange	
7	1	6	LD-2000 Butterfly	
8	1	6	A53 ERW Sch 40 Blk PE	6'-11 1/4"
9	1	6	A53 ERW Sch 40 Blk PE	17'-1 5/8"

Sample 2

- Bill of materials consists of:
  - Size (length, width, thickness)
  - Material type
  - Part name or item number
  - Number of pieces required
- Information may be supplemented with:
  - Shape of material
  - Nominal carbon content
  - AISI-SAE identification number

Sample 3:

ITEM NO.	AssemblyNo	PartNo	QTY	Description	MATERIAL	LENGTH	WEIGHT	Remarks
1	21050-A-16		1	CENTER ANCHOR SA	See BOM		1,233	SEE ASSY DWG
2		21050-P-01	2	TS1.25" x 1/8" wall	ASTM A36 Steel	218.50	32.363	
3		21050-P-20	2	TS1.25" x 1/8" wall	ASTM A36 Steel	59.63	8.831	
4		21050-P-25	54	TS.75" x 1/8" wall	ASTM A36 Steel	54.50	4.208	
5		21050-P-30	2	PL_0.1875	ASTM A36 Steel	4.00	0.816	
6		21050-P-35	2	PL_0.1875	ASTM A36 Steel	1.06	0.054	

(2) 2nd question How to list structural metal. Refer to some supplier hard copies or online websites with students. This is from the page under Structural Steel- angle from Russel Metals:

Angles

EQUAL LEG ANGLES

Size ins.	Thk. ins.	Wt. lbs./ft.
3/4 x 3/4	1/8	0.59
1 x 1	*1/8*	*0.8*
1 1/4 x 1 1/4	*1/8*	*1.01*
1 1/2 x 1 1/2	*1/8*	*1.23*
1 3/4 x 1 3/4	*1/8*	*1.44*
2 x 2	*1/8*	*1.65*
2 1/2 x 2 1/2	*1/8*	*2.08*
3 x 3	*3/16*	*3.7*
3 1/2 x 3 1/2	*1/4*	*5.8*
4 x 4	*1/4*	*6.6*
5 x 5	*5/16*	*10.3*
6 x 6	*5/16*	*12.4*
8 x 8	*1/2*	*26.4*

This is a sample from Central Steel:

Product	Specs	Size	Length	Depth d	Width b	Thickness t	Flange tf
ANGLE	GALVANIZED - ASTM A-36 & A-709 GR 36	L 3" X 3" - 5.243 LBS/FT	20'			1/4"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 2" - 3.07 LBS/FT	20'			3/16"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 2" - 3.07 LBS/FT	40'			3/16"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 3" - 3.71 LBS/FT	20'			3/16"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 3" - 3.71 LBS/FT	40'			3/16"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 2" - 4.1 LBS/FT	20'			1/4"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 2" - 4.1 LBS/FT	40'			1/4"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 2-1/2" - 4.5 LBS/FT	20'			1/4"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 2-1/2" - 4.5 LBS/FT	40'			1/4"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 3" - 4.9 LBS/FT	20'			1/4"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 3" - 4.9 LBS/FT	40'			1/4"	
ANGLE	ASTM A-36 & A-709 GR 36	L 3" X 2" - 5 LBS/FT	20'			5/16"	

NOTE: Include answer to each problem. Also state whether you anticipate students would struggle. How would you support the productive struggle? How would you facilitate the discussions?

PROBLEM SITUATION II : Creating BOM Pretest and Post test

See attached handouts and answers.

MAKING CONNECTIONS

The main idea is to make sure you know the Quantity required and multiply that by the required number for each item.

To figure out the Metric equivalent – multiply inch dimensions by 25.4 because 1" =25.4 mm.

A 20 foot piece of structural metal is 240 inches. Using inches is best for figuring out how parts fit into a length as the cut pieces are in inches.

State the main idea of the lesson: Creating a BOM in Blueprint Reading class will help for actual projects that need to be completed in the lab.