

**Consolidation of Accro Plastics and
Baxter Automotive Materials**

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July 1997

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1. Problem Description

In late 1994, Baxter Automotive made a strategic decision to acquire Accro Plastics Corporation of Cincinnati, Ohio. Baxter planned to consolidate Accro's existing technologies within an expansion of the Baxter Automotive Materials Plant in St. Louis, Missouri. The planned time frame for this relocation was a three month period from July 1995 to October 1995. In the process of acquiring and moving Accro's operations following this aggressive schedule, Baxter intends to retain virtually all of Accro's market share in the automotive acoustic business without disruption of deliveries to its two major customers; Ford and General Motors. In addition to creating problems associated with building adequate inventory to cover the three month period during which the Accro operations would be in transit to St. Louis, there was immediate pressure to prepare the St. Louis facility for the installation of the new operations and to start up full scale production of Accro's product lines. The most immediate needs included the siting of the major footings for the new facility expansion in St. Louis. This decision required knowledge of where the major workcenters of Accro's operations would be located in the new facility expansion.

The Accro Plastics Operation

The major workcenters of the Accro facility include; die cutting operations, the #4 calendar line, the #4 compound line, the outdoor storage silos, the #9 workstation, small and large ribbon blenders, the Viki rotary die cutter, the Hog regrinder, the Luigi extruder, and the Sterling extruder. A block plan for the existing Accro Plastics facility is included as Appendix 1 where the scale is approximately 25 ft. per inch.

The Accro Plastics Product Lines

Accro's major product lines are asphalt based, single and multi-layered automotive acoustic sheeting in roll and die cut form. Although the majority of Accro's output (as measured in total pounds) is die cut and packaged on shrink wrapped pallets, a significant proportion is sold directly in roll form. The primary inputs to all of Accro's product lines include asphalt, resins, pierex, dolomite and other inert (mostly ash) fillers, rubber powders, and paper used for backing. Accro's primary technology is a relatively simple process of blending the rubbers and fillers with asphalt and then extruding the mix into single layer or paperbacked sheeting. This is followed in most cases by die cutting, packaging and grinding of offal materials for recycling.

Accro's products can be classified within seven major product families which include; Series 350 Laminates, Plain Laminates, Multilayer Mastics, Series 600 Paper Backed Laminates, Series 350 Paper Backed Laminates, Expandables, and Coated Laminates. The processing of the Series 350 Laminate family of products starts with the manufacture of pellets from resin and regrind material in the #4 compounding area. The pellets are extruded into carrier sheet on the Luigi extruder. In parallel with this, fiber, zecco 110, slate, calcium oxide, zefree and mica are blended into a dry powder mix on the large ribbon blender. The dry powder mix and carrier sheet are combined with pierex, asphalt, and regrind at the #9 workstation where they are assembled into a roll product. The assembled roll is then die cut in the die cutting area and placed in finished goods storage. Offal is re-ground for recycling and placed in storage.

Plain laminates start with the blending of a rubber powder, calcium oxide and oil at the small ribbon blender. After the mix is placed in gaylord boxes, it is combined with asphalt, dolomite, and

additional regrind into a roll product at the #4 calendar line. The assembled roll is then flat die cut in the die cutting department and placed in finished goods storage with offal re-ground for recycling.

Multilayer mastics start with the manufacture of pellets from regrind and resin which are extruded on the Luigi workcenter. In parallel with this, rubber powder, calcium oxide and oil are blended at the small ribbon blender and stored in gaylords. The powder blend is combined with asphalt, dolomite, regrind and the extruded sheet into a roll product at the #4 calendar line. The assembled roll is rotary die cut and placed in finished goods storage with offal re-ground for recycling.

Series 600 paper backed laminates start with the blending of fiber, resin, zecco 110, slate, calcium oxide, zefree and mica into a dry powder mix on the large ribbon blender. The dry powder mix and two layers of scrim (thin paper backing) are combined with pierex, asphalt, and regrind at the #9 workstation where they are assembled into a roll product. The assembled roll is then flat die cut in the die cutting area and placed in finished goods storage with offal re-ground for recycling.

Series 350 paper backed laminates start with the blending of fiber, resin, zecco 110, slate, calcium oxide, zefree and mica into a dry powder mix on the large ribbon blender. The dry powder mix and one layer of scrim are combined with pierex, asphalt, and regrind at the #9 workstation where they are assembled into a roll product. The assembled roll is then rotary die cut and placed in finished goods storage with offal re-ground for recycling.

Expandables are manufactured by combining resin and regrind into pellets at the #4 compounding workcenter and then extruding the pellets into single layer sheeting at the Luigi extruder. The plain sheet is then flat die cut with offal reground for recycling. Coated laminates start with the blending of resin and calcium oxide on the small ribbon blender. These are combined with a rubber-pigment combination to produce pellets on the #4 calendar line. The pellets are extruded on the

Sterling extruder. Rolls are then rotary die cut with offal reground for recycling.

Exhibit 2 summarizes the routings associated with the production of a 600 lb. roll of each product. It should be noted that all rolls manufactured in the facility are approximately 60" in length, 18" in diameter and weigh approximately 600 lbs. Regrind materials and offal from dye cutting are transported within the facility in gaylord boxes which are 36" in height, moved on pallets and stackable to a height of three. Individual gaylord boxes weigh approximately 200 lbs. when filled with regrind or offal material. Bulk inputs (resin, pierex, dolomite and asphalt) are conveyed either pneumatically or by pipeline from exterior storage tanks. Oil must be combined at blending stations from bunged, chimed, 55 gallon, steel drums which arrive four to a pallet. The pallets with four drums each weigh approximately 2,000 lbs. All other raw materials arrive as bagged inputs on shrink wrapped pallets. In all cases these pallets contain fifty 20 lb. bags. The operator at the blending station must "break" the bags to add these inputs. Finally, die cut products are shipped on shrink wrapped pallets which weigh approximately 1,200 lbs.

Accro Plastics Product Line Markets

As mentioned above, Accro's primary customers are Ford and General Motors. In the past, Accro Plastics has manufactured to stock based on long range production forecasts at customer plants in conjunction with the bills of materials for each of 40 car models for which it has manufactured acoustic material in the past. Due to the reluctance of the automobile manufacturers to carry raw material inventories, Accro has been forced to supply customers on a nearly just-in-time basis. This has forced Accro to carry an average of about two weeks of production as finished goods inventory. This problem has been exacerbated by the fact that shipping schedules tend to be unpredictable over a planning horizon of more than a few days. Ultimately, Baxter would like to reduce this inventory

through more effective production scheduling and more accurate prediction of weekly order for shipping. Long range capacity planning has been based on published forecasts of auto production developed by DRI/McGraw Hill. Accro Plastics merely subscribes to the *DRI McGraw Hill Automotive Review* forecasting service and then projects long range demand based on bills of material explosion of auto industry forecasts.

2. Problem Statement

You are serving as a member of a four person consulting team that is responsible for designing an expansion of the Baxter Automotive Materials plant in St. Louis. The expansion is to be located within a rectangular area of dimension 200'x210' with adequate outside space for the bulk storage tankage. Based on the problem as described in this report, your assignment is to develop the following deliverables:

1. layout block plan for the major workcenters,
2. material flow plan,
3. materials handling methods and equipment specifications,
4. supporting storage system design.

The layout block plan for the major workcenters should include a floor plan of the work area and supporting storage areas. This should be a professional quality, easy to read, scaled rendering of the entire plant expansion. The material flow plan should show the flow of all raw materials, containers, work in process inventory, finished goods, and solid wastes throughout the production area. These flows should be represented on an easy-to-read diagram of the plant expansion floor plan. Materials handling methods and equipment specifications should describe in detail how all material movements take place in the plant and the corresponding equipment used. The supporting storage system design

should detail how all materials and equipment will be stored in the work area and the storage technology used. This should include sizing of the various storage areas, specification of rack systems, block stacking, tankage, etc.

3. Relevant Data

Specifications relevant to the problem include the following. St. Louis plant pallet specifications call for a 48"x48" square pallet with approximately 30" of bottom board. Drums in the plant are 36" in height, 38 lbs. in weight and 24" in diameter. Generally, they are constructed of steel with chimed sides, and resealable bunged tops. Gaylord boxes have 42"x42" footprint and are 36" in height. Overall, the facility must comply with Class I Division II electrical requirements. Table 1 summarizes the composition of each product family in terms of the percentage of raw material inputs. Table 2 summarizes Accro's estimated market share for each of the 40 car models for which it has supplied automotive acoustic during the past several years. The most recent two year DRI/McGraw Hill forecasts included in the bi-monthly publication are summarized in tables 3 and 4. Table 5 summarizes the bills of material information for the Accro product lines relative to each of the 40 car models.

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Table of Product Composition (in percentages):

Product Group:	1	2	3	4	5	6	7
<u>Inputs:</u>							
Resin	3	5	3	8	4	10	4
Regrind	38	22	20	10	40	50	26
Fiber	1	4	2	5	2	0	0
Zecco 110	1	0	2	4	1	0	0
Slate	2	0	3	1	2	0	0
Calcium Oxide	13	10	16	7	9	0	15
Zefree	1	0	6	4	1	0	0
Mica	8	3	4	4	8	0	0
Pierex	13	0	0	14	10	0	0
Asphalt	20	39	27	41	22	35	50
Rubber	0	2	5	0	0	0	0
Oil	0	3	2	0	0	0	0
Dolomite	0	12	10	0	0	0	0
Rubber-Pigment Mix	0	0	0	0	0	5	5
Scrim	0	0	0	2	1	0	0

Product Key:

1. Series 350 Laminates (0.26 lbs./ft²)
2. Plain Laminates (0.21 lbs./ft²)
3. Multilayer Mastics (0.29 lbs./ft²)
4. Series 600 Paper Backed Laminates (0.26 lbs./ft²)
5. Series 350 Paper Backed Laminates (0.26 lbs./ft²)
6. Expandables (0.23 lbs./ft²)
7. Coated Laminates (0.27 lbs./ft²)

Table 1. Accro Plastics Product Compositions in Percent by Product Family and Input Material.

	<u>Market Share:</u>
Century	12%
Ciera	36%
Bonneville H	55%
Lesabre	23%
Olds 88	85%
Caprice GM300	41%
Custom Cruiser	38%
Roadmaster Wagon	55%
Park Avenue	44%
Olds 98	85%
Allante	95%
Deville K	22%
Eldorado	22%
Seville K	22%
Riveria Q	22%
Toronado Q	12%
Cavalier L	19%
Corsica/Beretta	22%
Grand AM L	15%
Skylark L	15%
Sunbird L	8%
Lumina	17%
Regal W	26%
Reatta	95%
Corvette	31%
Tempo CD-W27	10%
Topaz CD-W27	10%
Escort CT20	9%
Tracer CT20	9%
Crown Victoria EN53	31%
Grand Marquis EN53	26%
Lincoln FN36	41%
Continental	29%
Mustang III	64%
Couger	30%
Thunderbird	30%
Taurus	12%
Sable	12%
Ranger Series	8%
FX Series	5%

Table 2. Market Share Estimates for Accro Plastics by Car Model.

	Jan 97	Feb 97	Mar 97	Apr 97	May 97	Jun 97	Jul 97	Aug 97	Sep 97	Oct 97	Nov 97	Dec 97
Century	2	3	8	7	3	5	12	12	10	7	0	7
Ciera	6	13	12	2	6	6	10	10	12	8	8	8
Bonneville H	6	9	7	7	5	6	9	3	3	4	6	3
Lesabre	16	13	19	16	21	3	2	23	18	4	4	5
Olds 88	12	21	5	1	10	13	5	8	5	10	2	7
Caprice GM300	7	25	3	3	14	0	14	3	17	20	16	22
Custom Cruiser	0	3	0	2	2	2	2	1	1	2	2	0
Roadmaster Wagon	1	1	4	1	4	2	2	1	2	1	1	0
Park Avenue	6	2	8	0	11	9	4	13	11	8	11	7
Olds 98	5	1	6	1	4	4	5	5	2	4	5	5
Allante	0	2	0	0	0	0	0	0	0	0	0	0
Deville K	19	9	24	24	2	0	6	16	20	25	6	7
Eldorado	4	2	0	3	4	3	1	2	1	2	4	2
Seville K	4	1	3	3	1	1	2	1	3	3	4	5
Riveria Q	2	2	3	3	1	0	3	2	3	1	3	2
Toronado Q	2	3	1	1	1	2	2	3	1	2	3	1
Cavalier L	16	4	20	42	15	11	2	10	18	20	23	40
Corsica/Beretta	4	20	35	13	24	20	23	7	17	9	2	2
Grand AM L	19	36	12	16	8	3	29	4	8	15	11	16
Skylark L	8	3	5	11	11	7	6	4	6	5	6	10
Sunbird L	1	12	3	5	3	10	14	5	1	0	11	7
Lumina	24	17	13	33	3	30	17	18	25	38	11	28
Regal W	19	1	0	14	13	7	3	5	20	7	10	9
Reatta	2	2	0	1	1	1	0	0	1	0	2	1
Corvette	2	2	3	3	1	2	2	1	0	2	2	1
Tempo CD-W27	8	23	25	12	3	36	3	33	5	13	3	2
Topaz CD-W27	8	3	5	8	8	9	2	7	1	6	1	8
Escort CT20	54	47	48	5	52	28	26	36	20	10	38	27
Tracer CT20	1	7	2	0	6	5	7	2	4	7	5	4
Crown Victoria EN5	10	4	4	14	13	12	8	13	10	11	15	4
Grand Marquis EN53	16	3	7	19	18	11	19	4	7	14	10	15
Lincoln FN36	20	15	6	22	0	4	17	18	14	0	8	21
Continental	1	1	7	7	1	1	3	3	8	2	6	3
Mustang III	9	1	10	10	10	5	11	4	1	7	7	6
Couger	11	1	3	5	5	4	7	6	8	13	5	5
Thunderbird	8	15	16	5	15	10	1	5	4	1	10	2
Taurus	41	18	10	31	5	15	7	37	12	54	25	9
Sable	8	9	16	7	4	15	6	16	5	7	9	2
Ranger Series	62	7	28	20	39	40	61	4	53	53	61	27
FX Series	15	27	15	13	27	6	6	10	27	20	20	6

Table 3. DRI/McGraw Hill Estimated Monthly Production (in Thousands of Units) by Car Model for 1997.

	Jan 98	Feb 98	Mar 98	Apr 98	May 98	Jun 98	Jul 98	Aug 98	Sep 98	Oct 98	Nov 98	Dec 98
Century	6	10	6	9	6	6	13	7	12	3	14	12
Ciera	0	8	14	1	15	1	5	4	7	6	2	11
Bonneville H	8	1	7	8	3	8	10	4	10	9	2	4
Lesabre	15	4	9	17	29	2	28	27	29	14	20	1
Olds 88	11	7	21	5	8	5	12	3	8	9	22	9
Caprice GM300	1	5	25	18	4	1	3	23	11	9	12	23
Custom Cruise	3	0	3	2	2	0	1	2	1	0	3	3
Roadmaster Wa	3	2	0	1	1	2	1	0	3	1	3	1
Park Avenue	11	7	10	0	14	3	1	4	6	3	2	6
Olds 98	7	2	4	1	4	3	0	0	2	4	0	6
Allante	0	0	0	0	0	0	0	0	0	0	0	0
Deville K	5	23	5	3	14	16	5	5	8	4	5	12
Eldorado	3	2	0	4	1	4	0	2	2	4	4	4
Seville K	1	5	1	3	1	3	4	2	3	0	1	5
Riveria Q	1	0	3	1	1	3	1	1	2	0	0	2
Toronado Q	0	1	3	0	0	3	0	2	4	2	1	1
Cavalier L	17	35	38	1	35	15	8	12	25	36	33	3
Corsica/Beret	41	40	25	5	31	1	33	31	17	29	36	14
Grand AM L	1	30	19	13	23	5	19	29	3	24	23	35
Skylark L	8	6	9	11	5	5	9	11	8	10	11	7
Sunbird L	6	11	5	11	9	7	15	8	4	7	4	1
Lumina	28	16	5	37	5	10	31	23	13	23	10	1
Regal W	15	3	19	14	11	14	2	4	7	7	4	9
Reatta	1	1	1	0	1	0	1	2	0	1	0	2
Corvette	3	0	1	1	1	2	3	0	2	2	1	1
Tempo CD-W27	32	10	32	26	9	30	15	3	25	28	16	29
Topaz CD-W27	7	10	2	10	9	0	8	7	7	1	9	7
Escort CT20	31	35	29	38	13	13	10	36	46	9	24	5
Tracer CT20	3	1	4	7	3	1	7	4	6	3	1	8
Crown Victori	7	7	10	14	12	14	1	6	9	13	6	1
Grand Marquis	7	5	6	17	14	10	1	9	9	16	17	8
Lincoln FN36	12	10	12	3	8	7	6	8	18	1	11	18
Continental	1	4	4	7	8	6	2	6	2	5	7	3
Mustang III	2	11	10	5	9	3	5	9	8	2	4	9
Couger	11	12	5	1	8	8	8	9	12	6	2	4
Thunderbird	12	1	7	4	14	14	6	4	8	16	10	13
Taurus	33	15	27	2	13	36	39	3	37	15	20	14
Sable	2	11	7	0	15	4	3	8	1	8	5	11
Ranger Series	56	38	11	17	59	59	4	25	27	1	7	22
FX Series	14	26	22	26	25	14	27	25	16	22	13	18

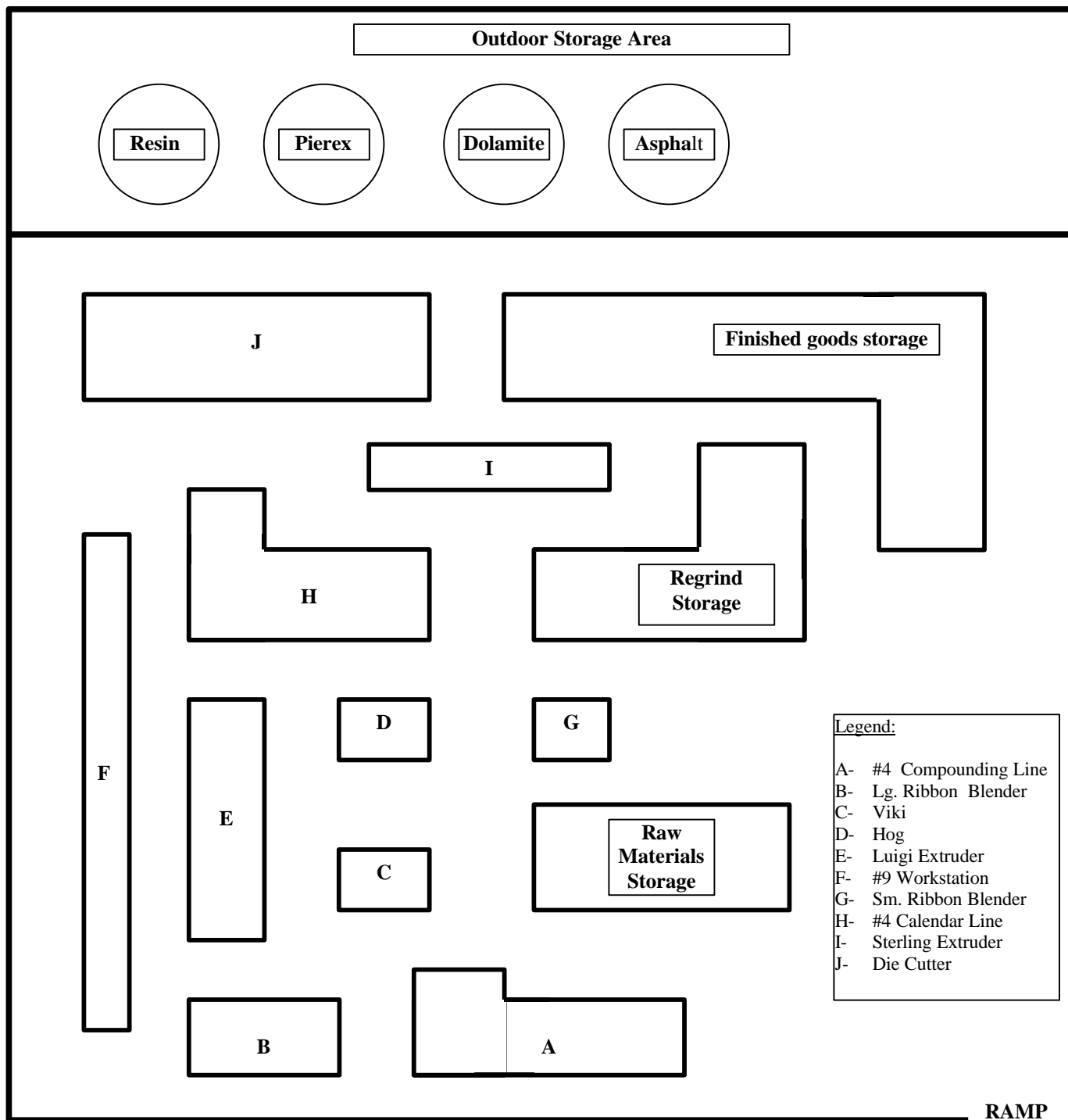
Table 4. DRI/McGraw Hill Estimated Monthly Production (in Thousands of Units) by Car Model for 1998.

	S350	Plain	MM	S600P	S350P	Ex	CL
Century	16					12	
Ciera			22				
Bonneville H				18			8
Lesabre		12			14		
Olds 88	12					24	
Caprice GM300		24	12				
Custom Cruiser		16			22		
Roadmaster Wagon		24	12				
Park Avenue	32						
Olds 98	12					24	
Allante			24		8		
Deville K				32			12
Eldorado				24			12
Seville K				24	24		
Riveria Q	24	12					
Toronado Q	24	12					
Cavalier L			12		8		
Corsica/Beretta			18		8		
Grand AM L			12		8		
Skylark L		8	18				
Sunbird L			12		8		
Lumina		8	24				
Regal W	16					12	
Reatta	18			8			
Corvette				24			
Tempo CD-W27					4		24
Topaz CD-W27					4		24
Escort CT20				12			18
Tracer CT20				12			18
Crown Victoria EN53			24				24
Grand Marquis EN53			18				24
Lincoln FN36							32
Continental			12				24
Mustang III					12	18	
Couger			8				24
Thunderbird			8				24
Taurus					24	4	
Sable					24	4	
Ranger Series		18					
FX Series		32					

Table 5. Accro Plastics Bills of Material by Product Family and Car Model in Square Feet per Unit.

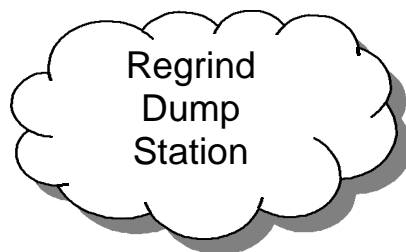
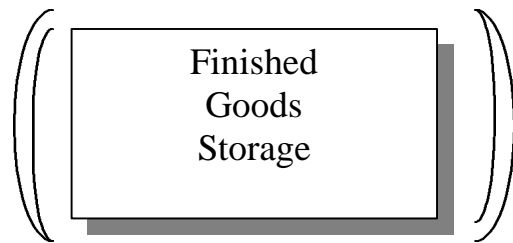
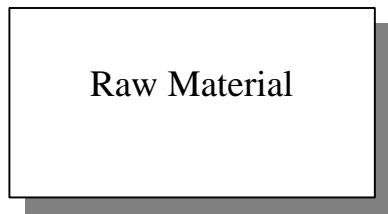
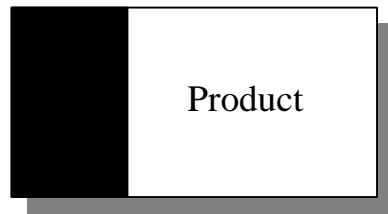
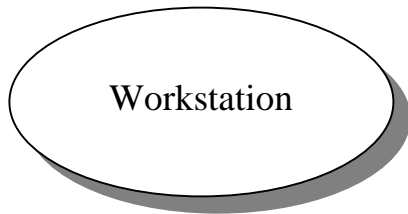
Appendix 1: Scaled Block Layout Plan of the Existing Accro Plastics Facility.

LAYOUT FLOOR PLAN

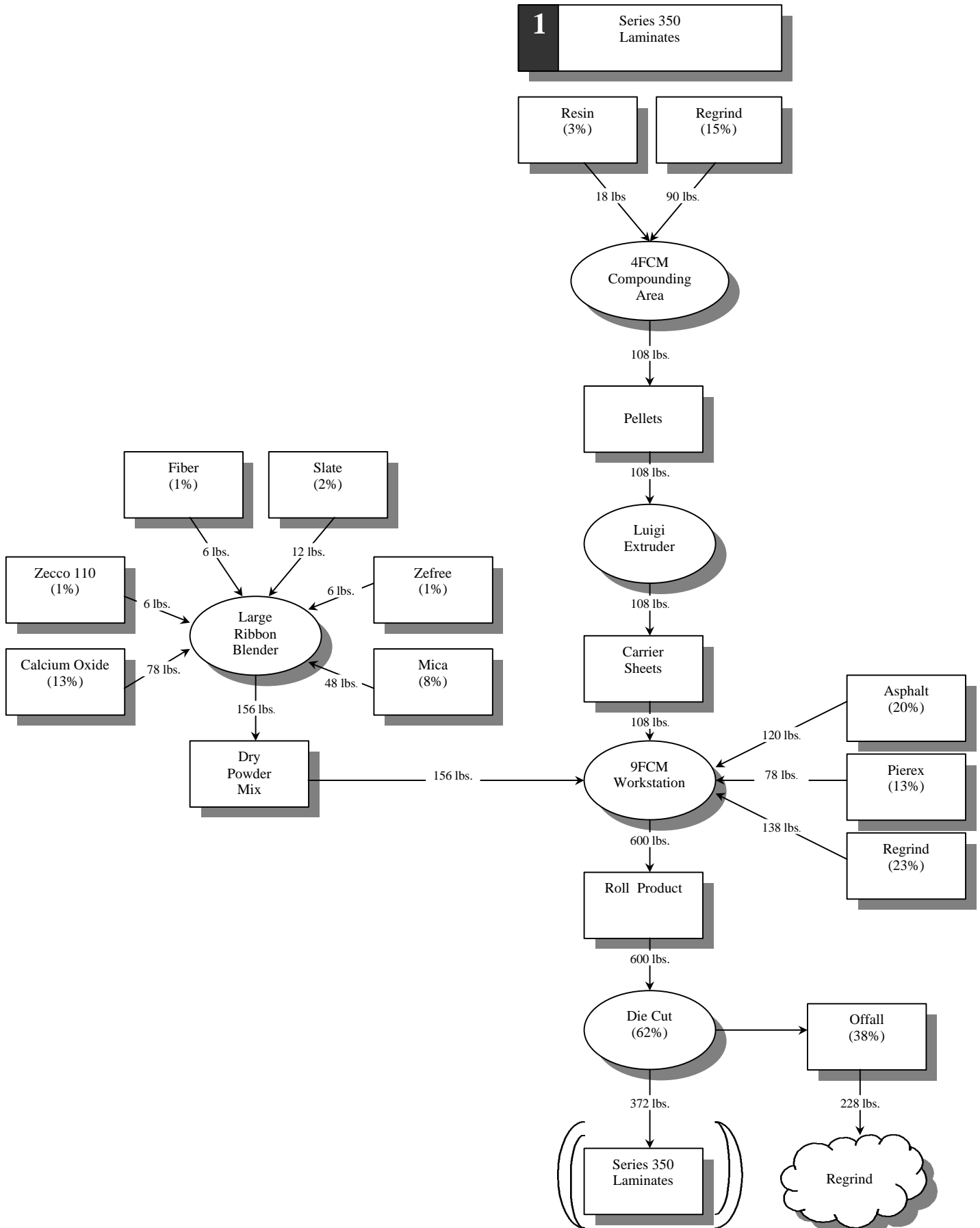


Appendix 2: The Accro Product Family Process Summary Sheets for 600 lb. Roll Products.

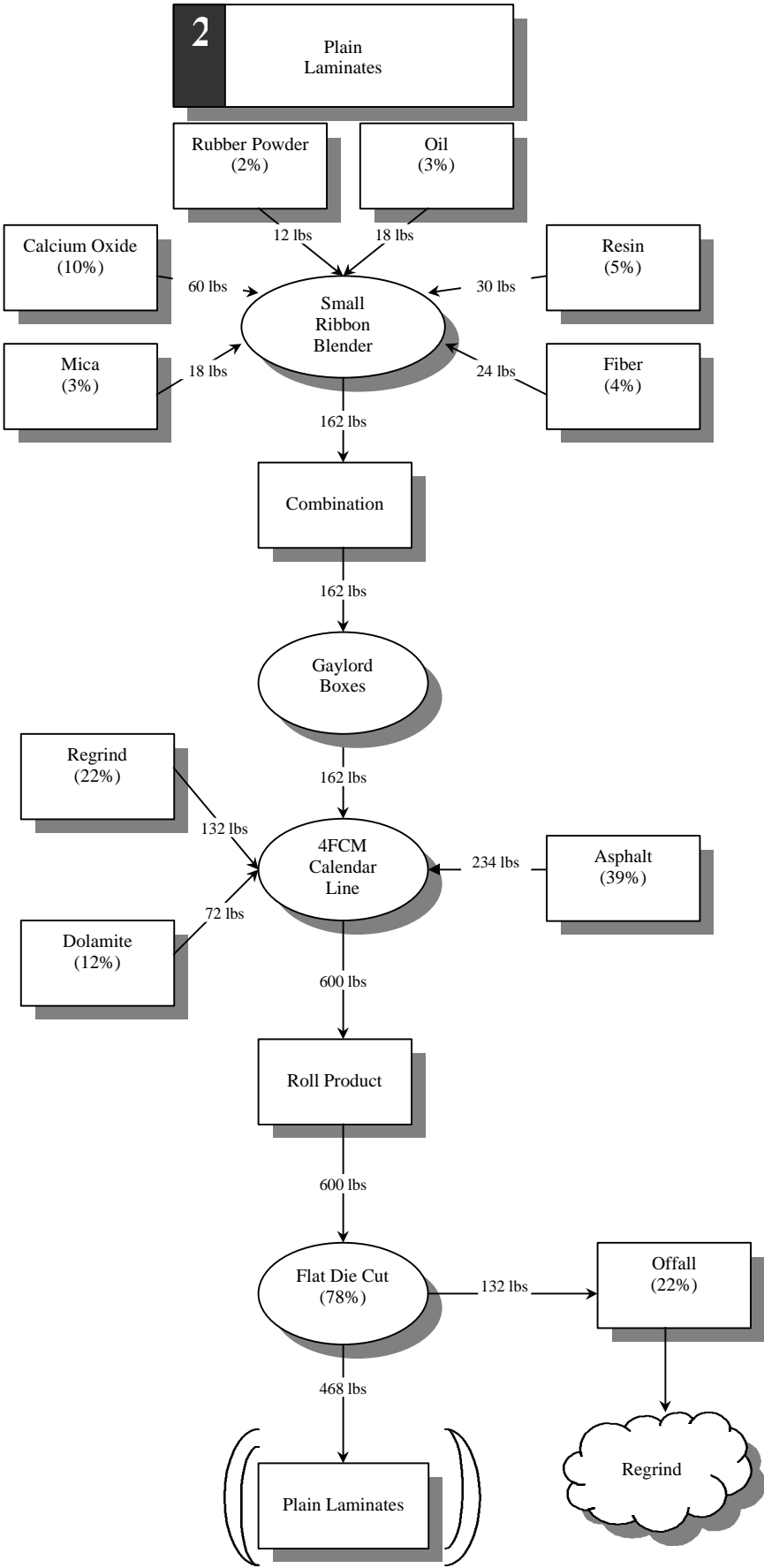
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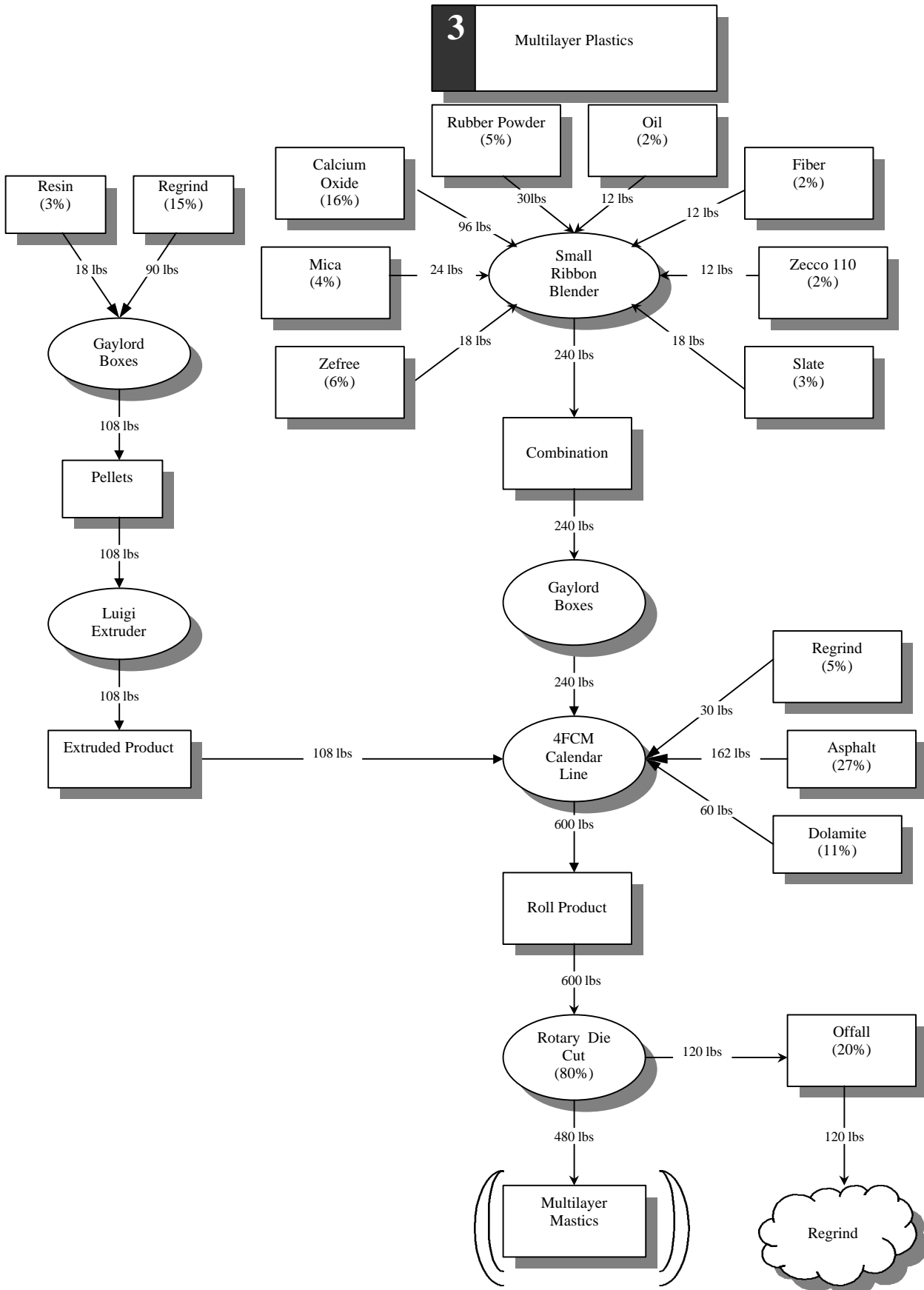
Material Flow Diagram



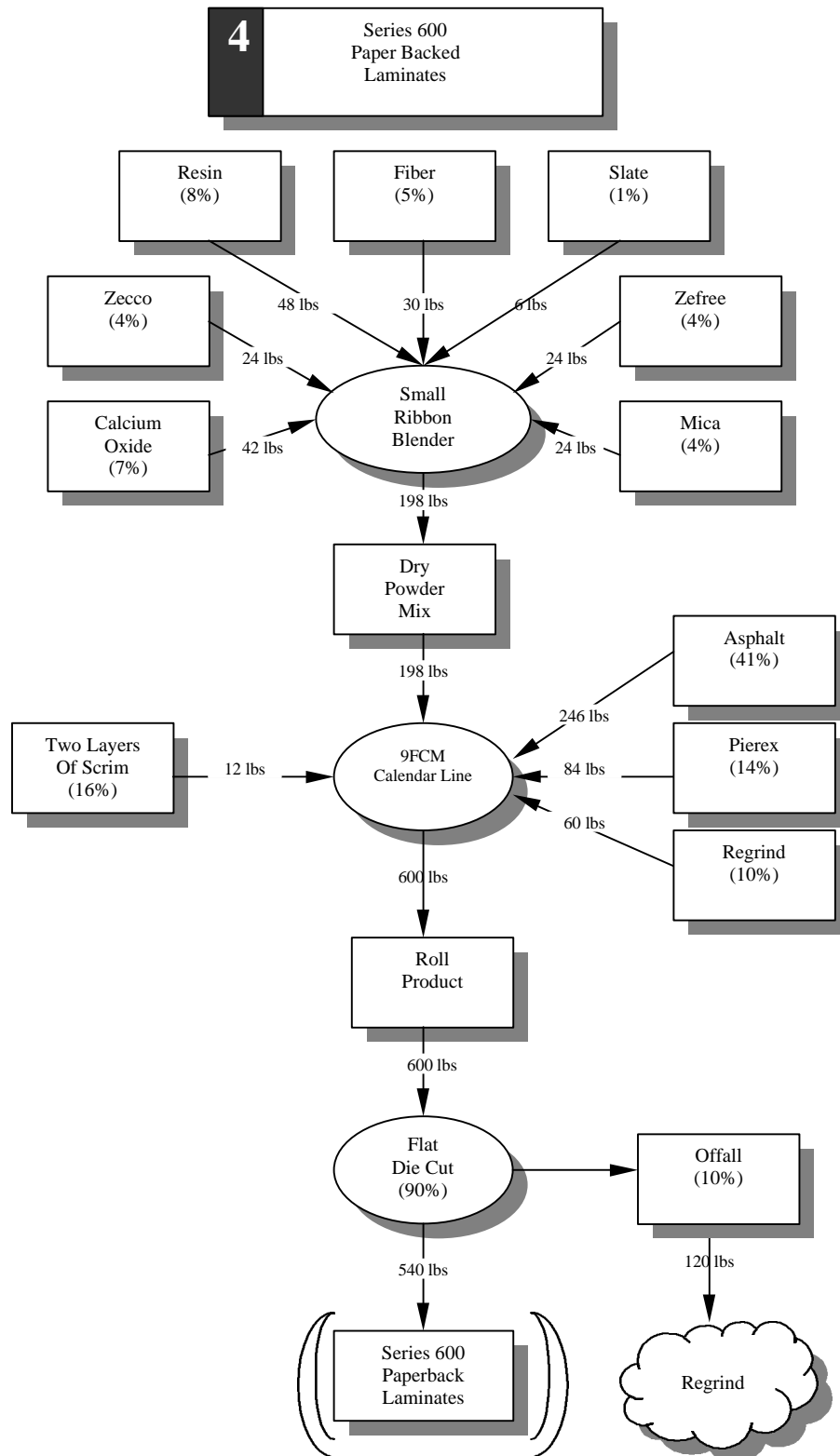
Material Flow Diagram



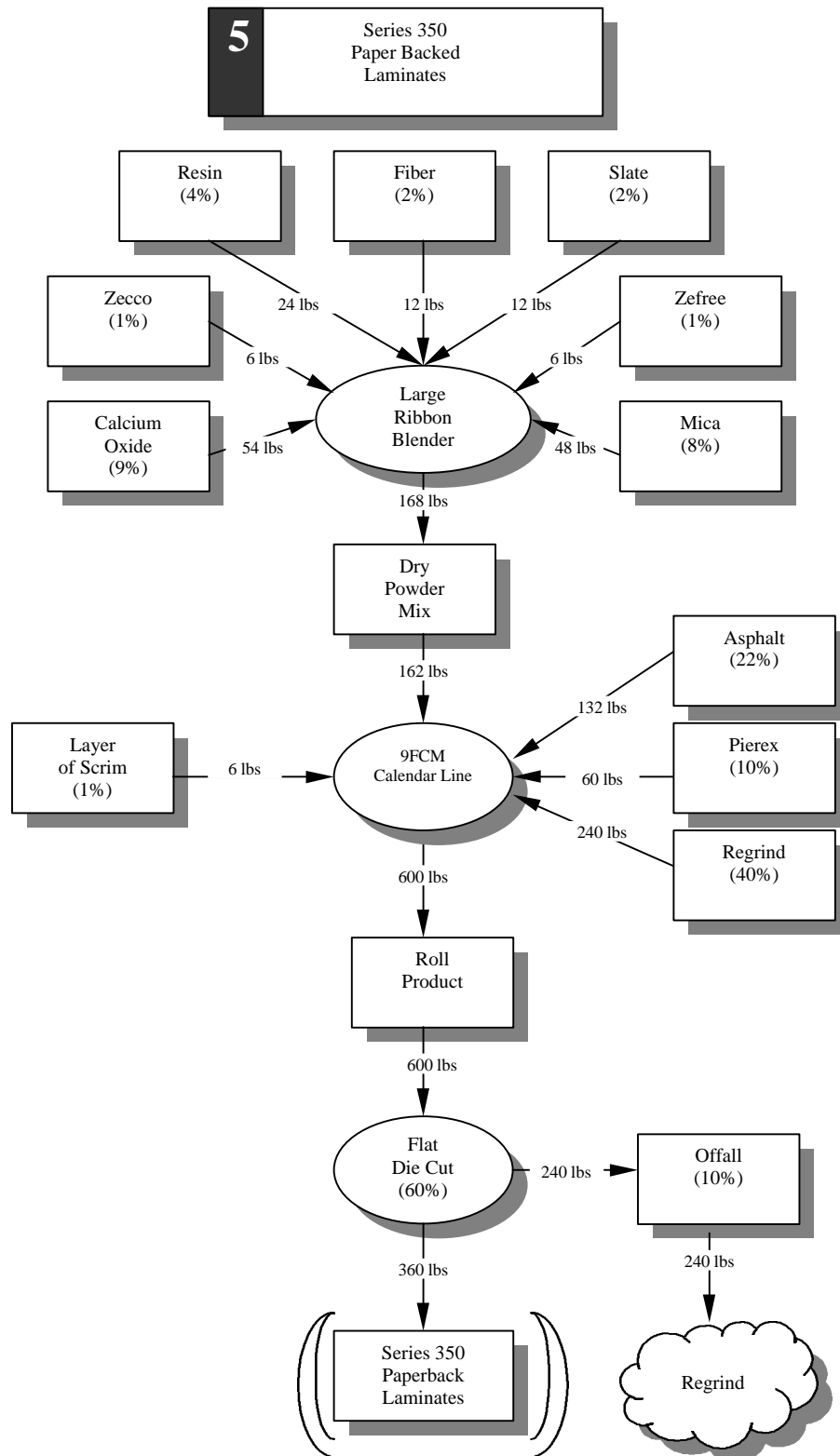
Material Flow Diagram



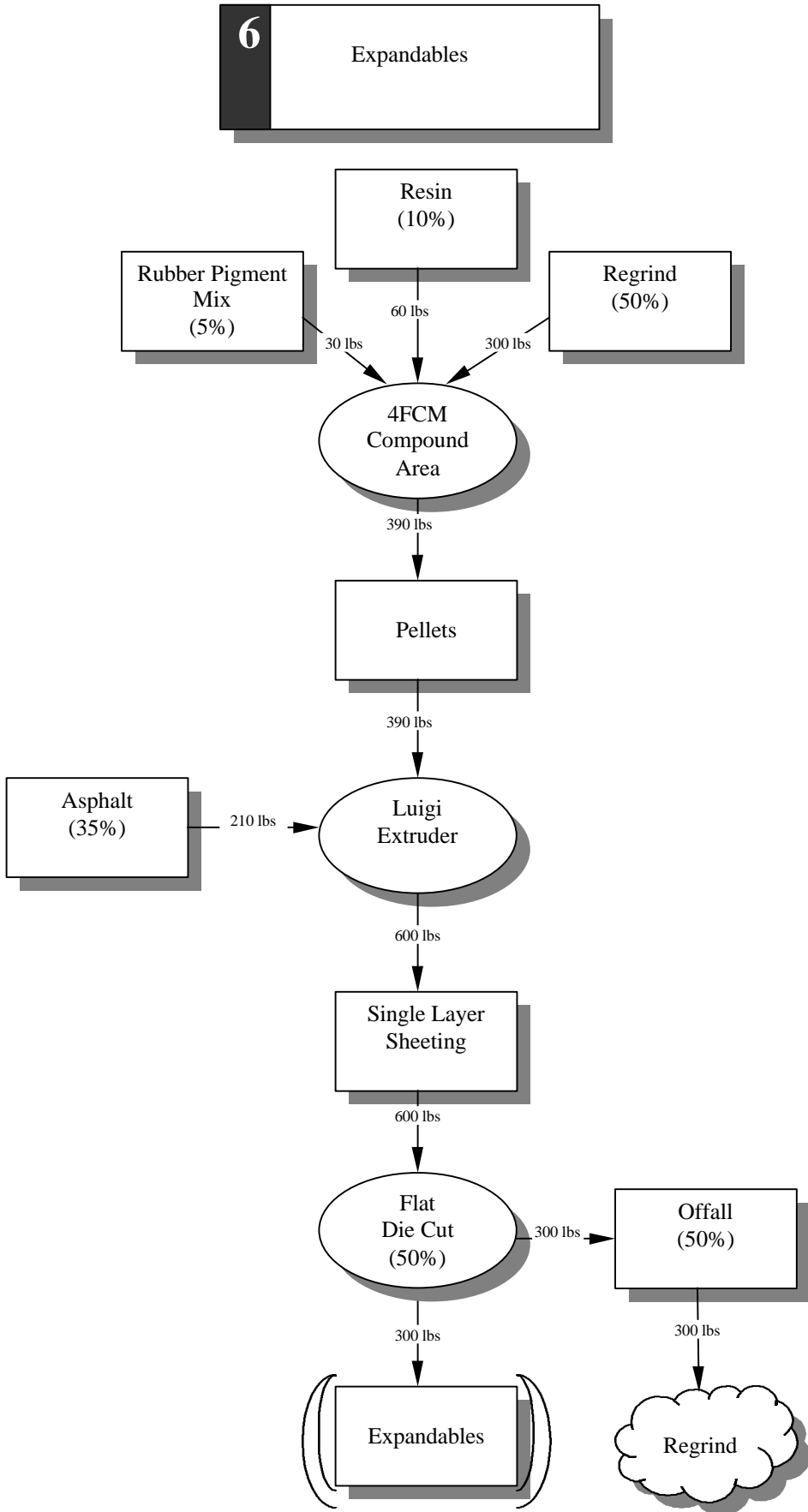
Material Flow Diagram



Material Flow Diagram



Material Flow Diagram



Material Flow Diagram

