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CONTRACTING RAIL FREIGHT SERVICES FOR POULTRY FEED INGREDIENTS MOVING TO THE SOUTH

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ABSTRACT

Southeastern integrated poultry firms consume large volumes of feed grains, at concentrated locations, continuously throughout the year. Recent legislation offers flexibility in contracting railroad freight rates and services which may be quite useful to improve the quality and price of feed grain delivery to southeastern poultry firms. However, southeastern poultry feeders have adjusted feed material storage and handling facilities to a railroad rate structure in which minimum possible freight and inventory cost is achieved by receiving 3-car shipments of corn and 1-car shipments of soybean meal. Consequently, for most poultry firms, larger delivery volumes necessary to achieve railroad rate savings with rail contracting are accompanied by increases in total handling and storage facility requirements and increased inventory costs.

Increased inventory and facility upgrading costs must be compared with railroad rate savings anticipated with a contract. Before negotiating a contract, the user firm should determine the magnitude of facility upgrading and inventory expenses involved to establish the boundaries of rate concessions acceptable in a contract. This bulletin provides a method to evaluate the merits of railroad contracting for feed ingredient delivery to poultry feed mills, relative to existing delivery patterns and serves as an approach to prepare for rail contract negotiations.

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CONTRACTING RAIL FREIGHT SERVICES FOR POULTRY FEED INGREDIENTS MOVING TO THE SOUTH

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The Staggers Rail Act of 1980 allows commodity shippers and railroads to contract for transportation services.[1] Negotiable contract terms include rates, delivery schedules and provision of transport equipment. A contract permits railroads and shippers to recognize the unique goals and transportation requirements of individual shippers and to arrive at a service and rate package which represents a mutual gain. Contracting permits shippers to seek specific services and to identify the willingness of railroads to provide these tailored services at a negotiated price.

Railroad contracting represents a substantial gain in flexibility over the formerly rigidly regulated rail freight market where all services and rates were applicable to all who bought services, which meant that service provisions had to be general enough and rates high enough to cover the average cost of handling freight from all who requested service. Now, special services can be contracted at compensatory rates to fit individual shipper operating patterns.

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[1]Railroad contracting rules were established first by the Interstate Commerce Commission in _Ex Parte_ No. 358, Sub. 1, and subsequently legislated in the Staggers Rail Act of 1980.

Feasibility and appropriateness of railroad contracting for a commodity-using firm depends on existing facilities and the pattern of commodity usage. Under a railroad contract, a firm likely would be limited to 24 hours to load or unload a shipment. Consider a contract to deliver 25 carloads of grain each month to a feed manufacturer. The feed manufacturer would have to have direct service on a railroad line which could carry loaded 100-ton cars. The firm would have to have track storage space to hold 25 cars while being unloaded, a 5,000 bushel per hour hopper car unloading capacity, 85,000 bushels of available grain storage space, a $250,000 to $415,000 credit line ($3 to $5 delivered corn price) to make payment and a continuous 2,800 bushel per day grain utilization. Failure in any one of these characteristics would require additional investment to make this contract feasible from a technical point of view.

Larger delivery volumes necessary to achieve railroad rate savings are accompanied by increases in total handling and storage facility requirements and increased inventory costs. Increased inventory and facility upgrading costs must be compared with railroad rate savings anticipated with a contract. Before negotiating a contract, the user firm should determine the magnitude of facility upgrading and inventory expenses involved to establish the boundaries of rate concessions acceptable in a contract.

Groups of commodity-using firms also may contract with a railroad for transportation services. Consequently, where several feed users are located near to one another and are on railroad lines operated by the same railroad company, there is a possibility of combining orders for feed materials at a single origin, having materials delivered in a unified shipment and designating certain numbers of carloads to be delivered to designated destinations.

Southeastern integrated poultry firms consume large volumes of feed grains, at concentrated locations, continuously throughout the year. Recently acquired flexibility in contracting railroad freight rates may be quite useful to improve the quality and price of feed grain delivery to southeastern poultry firms. The objectives of this report are to: (a) present results of a survey on the physical handling facilities available for grain receiving at poultry feed mills in the southeastern United States, (b) describe the possibilities of joint action by several firms to achieve feed delivery savings and (c) describe and demonstrate a procedure by which poultry feeders can prepare for contract rail rate negotiations.

A Survey of Existing Feed Delivery Schedules

A survey questionnaire soliciting information on feed material delivery facilities existing in 1980 was sent to 243 feed mills from Delaware to Texas. Sixty-nine questionnaires were returned (28.4 percent) of which 57 (23.5 percent) were usable for the following description of the industry.[2] Of the 57 feed mills reporting, 54 were served directly by rail line spurs and two others had nearby access.[3] Only one mill was served by a rail line incapable of delivering fully loaded, 100-ton hopper cars of feed. Only two mills were served by more than one railroad company, and each of these was served by two railroads.

Unloading track capacity represents the number of hopper cars which could be delivered to a mill for unloading at a single railroad delivery. The mill must have enough track space to move all of the delivered cars over the dump pit for unloading without the aid of railroad power and without blocking the railroad right-of-way. Of the 54 firms reporting, 49 could receive no more than 15 cars (see Table 1). The average unloading track capacity is 10 cars.

Rail car unloading capacity represents the rate at which feed ingredients can be unloaded from rail cars once the cars are delivered to a mill. Although a hopper car carries roughly 3,300 bushels of corn, a

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[2]The locational distribution of the 57 reporting feed mills by state is as follows: North Carolina - 15; Georgia - 10; Florida - 5; Alabama - 5; Arkansas - 4; Texas - 4; Mississippi - 4; Maryland - 3; Virginia - 3; Louisiana - 1; South Carolina - 1; Delaware - 1; West Virginia - 1.

[3]The distribution of the 57 reporting feed mills by serving railroad is as follows: Family Lines (SCL, L&N, etc.) - 22; Southern - 17; ConRail - 4; Illinois Central Gulf - 3; Kansas City Southern - 2; Southern Pacific - 2; Norfolk and Western - 1; Burlington Northern - 1; Missouri Pacific - 1; Atchison, Topeka and Santa Fe - 1; St. Louis-San Francisco - 1; South Brand Valley - 1.

Table 1. Unloading Track Capacity

No. cars	No. mills
0 - 5	9
6 -10	28
11 -15	12
16 -20	0
21 -25	3
26 -30	1
31 -35	1
	54

5,000 bushel per hour capacity probably is required to unload a car per hour on a continuous basis. This is equivalent to more than a 70 ton per hour granular unloading capacity for soybean meal. Rail car unloading capacities for responding firms are shown in Table 2. Of 55 firms reporting rail corn receipts, 46 (84 percent) are unable to unload one car per hour, but nearly all mills can unload three cars in 8 hours (a 1,250 bushel per hour capacity). Similarly, 37 of 53 firms reporting (70 percent) are unable to unload one car of soybean meal per hour, but nearly all can unload one car in 8 hours (an 8.8 tons per hour capacity).

Storage space represents protective housing for feed material between delivery and use. A mill must have sufficient space to house a volume of grain received in a single delivery plus some additional space to hold a reserve stock from previous deliveries to keep the probability of a feed material stockout low. Existing storage space available at the 57 responding feed mills is shown in Table 3. No reporting firm has less storage space than that required to house five carloads of corn, but 29 mills have less than the 85,000 bushels of space required to receive a 25-car delivery. Of 57 reporting mills, 24 mills could not receive more than one carload of soybean meal at a time due to the storage space restriction. Consequently, storage space is not a commonly restrictive factor in receiving volume shipments of corn, but it does limit volume railroad shipments of soybean meal.

Under conventional operating patterns, the track, unloading and storage capacities prevalent in the industry are quite adequate. Since historically the lowest rail rate available for corn was on the 3-car multiple shipment, there was little incentive for receivers to order more than three carloads at a time; larger shipments would yield no transport rate savings and would increase inventory costs. The exception is when three carloads of corn simply is insufficient to feed very large flocks served by the largest feed mills. Soybean meal transport is priced using only single-car rates. Transportation directors have adjusted accordingly by receiving single-car shipments, typically.

The predominance of 3-car corn deliveries and 1-car soybean meal deliveries (corresponding to the least delivery volume receivable at the least transport rate) is revealed in Table 4. These small delivery volumes serve as a means of controlling both transport and inventory

Table 2. Rail Car Unloading Capacities

Corn		Soybean meal	
Bu./hr.	No. firms	Tons/hr.	No. firms
1- 2,500	19	1- 25	4
2,501- 5,000	27	26- 50	16
5,001- 7,500	5	51- 75	17
7,501-10,000	2	76-100	10
10,001+	2	101+	6
	55		53

Table 3. Storage Space

Corn		Soybean meal	
Bushels	No. mills	Tons	No. mills
0- 50,000	14	1-200	24
50,001- 100,000	18	201-400	26
100,001- 300,000	10	401-600	3
300,001- 650,000	6	601+	4
650,001-1,000,000	4		57
1,000,001-1,500,000	3		
1,500,001+	2		
	57		

Table 4. Current Carloads per Delivery

Corn		Soybean meal	
No. cars	No. mills	No. cars	No. mills
0	3	0	14
3	47	1	38
5	1	2	1
6	2	4	2
12	2	5	1
15	1	6	1
25	1		57
	57		

costs to the extent possible. Of the 54 mills reporting corn receipts by railroad, 47 (87 percent) typically receive 3-car shipments. Of the 43 mills reporting soybean meal receipts by railroad, 38 (88 percent) typically receive single-car shipments.

Feasibility of volume feed shipment also depends upon the annual volume or rate of use. Inventory cost control requires that shipment size be related to rate of use as well as transport cost. The annual volumes of corn and soybean meal receipts for 1978 and 1979 for most of the responding firms are shown in Table 5. The average of corn receipts in 1979 was 3.4 million bushels which is equivalent to 20 carloads per week. The 62 percent of firms receiving 3 million bushels of corn or less during 1979 had average receipts of 2 million bushels which is equivalent to 12 carloads per week. Average 1979 soybean meal receipts were 27,000 tons which is equivalent to 7 or 8 carloads per week.

Joint Contracting

The Staggers Rail Act of 1980 specifically permits groups of shippers and groups of railroads to construct a rail service contract. Large-volume, regular shipments which are attractive to railroads may be useful for groups of feed material receivers when individual receivers cannot justify the volume. Such a contract would entail joint purchase of feed materials at a common location and movement of materials for several mills on the same freight bill. The shipment would be delivered to a rail yard near the receiving locations and multiple-car units would be delivered to individual feed mills for unloading and the empty cars returned to the rail yard for the return trip to the origin.

Poultry feed mill locations which lie near one another on lines of the same railroad are grouped in Table 6. The number of poultry firms and the serving railroad are provided in the table. In addition, there are several towns with more than one poultry feeder which are not listed, such as Athens, Georgia, and Dallas, Texas.

When a group of shippers join together to contract for railroad services, it may be necessary for one party to be responsible for receipt of billings, payment and filing of claims. This may be done by

Table 5. Corn and Soybean Meal Receipts, 1978-79

Corn			Soybean meal		
Million bushels	No. firms 1978	No. firms 1979	Thousand tons	No. firms 1978	No. firms 1979
0- 1	5	3	1-10	8	6
1- 2	16	16	10-20	13	15
2- 3	15	15	20-30	18	19
3- 4	6	10	30-40	5	6
4- 5	4	0	40-50	4	2
5-10	5	9	50+	5	7
10+	2	2		53	55
	53	55			

Table 6. Locational Groups of Poultry Firms for Possible Joint Contracting for Railroad Services

No. firms	Railroad	Location
8	ConRail	Milford, Millsboro, Shelbyville, DL; Showell, Berlin, MD
6	ConRail	Seaford, DL; Temperenceville, Accomac, VA; Hurlock, Salisbury, Parsonsburg, MD
3	ConRail	Cordova, Easton, MD
5	Southern	Edinburg, Broadway, Harrisonburg, Dayton, VA
6	SCL	Monroe, Marshville, Rockingham, Ellerbe, NC
5	Southern	Siler City, Staley, Sanford, NC
3	SCL	Rose Hill, Warsaw, NC
2	SCL	Greenville, Robersonville, NC
3	Southern	Batesburg, Leesville, Ward, SC
3	Southern	Carrollton, GA; Heflin, Oxford, AL
5	L&N	Elijay, Canton, Marietta, GA
7	Southern	Gainesville, Baldwin, GA
2	SCL	Camilla, Thomasville, GA
2	Southern	Pine Mountain, Columbus, GA
3	SCL	Madison, Lee, Live Oak, FL
2	L&N	Crestview, DeFuniak Springs, FL
4	L&N	Athens, Decatur, Cullman, AL
5	L&N	Albertsville, Boaz, Gadsden, AL
2	Southern	Delmar, Jasper, AL
3	Southern	Montgomery, Union Springs, AL
5	ICG	Canton, Madison, Jackson, Hazelhurst, MS
8	ICG	Pelahatchie, Morton, Forest, MS
4	ICG	Bay Springs, Laurel, MS
3	ICG	Magee, Collins, Hattiesburg, MS
2	MoPac	Eunice, Opelousas, LA
3	SSW	Pine Bluff, Rison, AR
3	SSW	Texarkana, AR; Mt. Pleasant, TX
2	KCSo	Grannis, DeQueen, AR
3	MoPac	Clarksville, Russelville, Dardanelle, AR
2	KCSo	Decatur, Siloam Springs, AR
5	SLSF	Bentonville, Springdale, AR
5	ATSF	Carthage, Tenaha, Center, Jasper, TX
3	SoPac	Teneha, Nacogdoches, Lufkin, TX

one receiver in the group volunteering to act as the formal "receiver" to collect payments and handle the paperwork. Separate contracts between the formal receiver and other parties in the group would be necessary to prevent all liability from falling on the formal receiver.

Another alternative for joint railroad contracting is establishment of a nonprofit shippers association corporation with membership limited to participants in the railroad contract. The shippers association would be the formal receiver and contractor with the railroad. Each member firm would have a representative on the Board of Directors of the shippers association and an employee of the association would collect payments for materials and freight from individual members, forward payments to the railroad and handle any necessary filing of claims. The employee of the association could serve part-time and be a regular employee of one of the member firms, with the association reimbursing the employing member firm for services of the employee. A shipper association can serve in this capacity as long as the Interstate Commerce Commission does not find that the association is operating as a profit-making corporation or organizing freight movements for nonmember firms. A shippers association formed solely to arrange joint shipments of feed materials for member firms, with rate savings passed on to members, should have no problem in maintaining shipper association status as opposed to for-profit freight forwarder status which entails numerous ICC regulations.

A third alternative for achieving lower, large-volume rail rates is to contract with the railroad as a group and to be billed individually. This is equivalent to a number of independent receivers each ordering shipments individually but at the same time. This approach removes the advantage of single-billing to the railroad.

Developing Precontract Information

Contract terms for railroad services require negotiation between railroads and shippers. The railroad knows a great deal about railroad objectives and costs of operation and very little about the objectives and costs of shippers. Similarly, the shipper knows a great deal about shipper objectives and costs of operation and very little about those of the railroad. It would be fruitless for a feed material receiver to base a rail rate reduction proposal on his estimate of railroad cost savings attributable to a change in service pattern.

A useful strategy for a feed ingredient receiver or group of receivers is to enter railroad contract negotiations with an understanding of the minimum rate reduction required to compensate for additional receiver expenses associated with each of a number of desirable service options. Preparation for negotiation with a railroad requires seven steps:

Step 1. Develop delivery schedule options

Step 2. Calculate material price differences between sources

Step 3. Calculate current freight differences between sources

Step 4. Calculate storage cost differences

Step 5. Calculate facility investment costs

Step 6. Calculate quality, risk and convenience premiums

Step 7. Calculate minimum rate reductions on delivery options.

Step 1 outlines the types of transport service changes which a receiver might be willing to work with in negotiations. Steps 2 through 6 develop information on the costs and benefits to the receiver of changing to each delivery option. Step 7 summarizes cost and benefit information into minimum rate reductions required for each option to be attractive to the receiver. Procedures for accomplishing each step are developed and demonstrated in the following sections.

Procedures for developing precontract information are illustrated with application to a realistic, but hypothetical case example. Consider three southeastern feed mills located on a common rail line in a region of substantial corn production. Feed mills currently rely on local corn supplies to satisfy most of annual usage with residual backup from midwestern sources. The best transportation rates for corn from the Midwest are 3-car railroad rates from Cincinnati. Railroad contract options would turn this situation around to rely on midwestern sources as primary suppliers and local sources as residual suppliers. Basic data required to evaluate the positions of receivers include corn utilization, storage capacity, track space, grain car unloading capacity and current railroad rates from the Midwest. Table 7 contains these data for each of the three hypothetical feed mills being observed.

Table 7. Basic Data for Evaluating Contract Options for Corn, Mills A, B, C

Description	Mill A	Mill B	Mill C
Rail Siding	XYZ	XYZ	XYZ
Corn Utilization (bu./yr.)	3,500,000	5,000,000	1,500,000
Corn Storage (bu.)	800,000	100,000	600,000
Track Space (cars)	7	25	10
Grain Car Unload Rate (bu./hr.)	10,000	6,000	8,000
Rail Rate from Midwest Origin $/bu.	0.60	0.60	0.60

Step 1. Delivery Options

A perfect material delivery system, from a logistical viewpoint, is one with continuous delivery of materials directly into the feed mixer, avoiding storage and handling. However, this delivery system would be very expensive. Consequently, one must consider trade-offs between delivery services and costs of services, expecting to pay more for finer service.

Before entering negotiations with a railroad, a feed material receiver should understand the limits of his own bargaining position. Each party is negotiating to improve its own condition. Only if the conditions of both parties are improved will there be a change mutually agreed upon.

Railroads achieve cost economies by handling high-volume, regular shipments. Less time and cost are required to handle cars and paperwork if many cars move together at one time, on a single billing. Revenue security and equipment utilization are improved with a minimum annual volume guarantee and shipment regularity. These are the attributes railroads will be seeking in a contract. If a receiver is willing to receive larger volumes per shipment for an incentive rate reduction, there may be an opportunity for negotiation.

The receiver begins by describing a number of possible delivery options which will satisfy feed material utilization rates within the feed mill and have a potential for attracting railroad interest. Important delivery characteristics to be considered in developing options are: (a) the proportion of total material use to be contracted and (b) frequency of delivery.

When poultry markets are somewhat volatile, it may be unwise to enter a long-term contract for transportation of 100 percent of feed ingredients, especially when local supplies are available. Local availability of a feed material serves as a buffer stock against surge demands of materials in the mill. With product price fluctuations, a receiver may desire flexibility to reduce material intake in the event product prices fall resulting in flock size or market weight reductions. The higher delivered cost of the fill-in portion of material receipts can be considered an insurance premium paid to insure against accumulating inventories of materials in a product market downturn period.

The more stable is the product market price and the larger is the expected difference between contract and noncontract material delivery costs, the larger the proportion of material use one might wish to contract transportation to carry. One might consider delivery options such as constant deliveries of 100, 80, 67 or 50 percent of use or rely on local harvest to fill existing storage facilities and contract for transportation of materials to fill a portion of use during the rest of the year. Also, one might consider contracting to guarantee a minimum volume with the reduced, contract transport rate applying to all quantities delivered.

A receiver also must consider frequency of material delivery. The more frequent the delivery, the smaller will be the volume at each delivery and the lower will be the handling facility requirements and inventory costs. However, railroads achieve cost economies with large deliveries. As long as rate reductions compensate for the additional facilities and inventory costs attributable to larger deliveries, the receiver may be indifferent between two or more delivery frequencies. One might consider delivery frequency of twice weekly, weekly, every 10 days or biweekly. If a specific number of carloads per shipment is being considered, such as a 20-car unit, service frequency should match the period in which 20 carloads of materials are used.

When one or a group of receivers uses sufficient amounts of materials to justify dedication of a unit train for delivery, even greater railroad cost economies can be achieved, which may result in even greater rate reductions. For example, a 65-car unit train may require a 10-day turnaround schedule. In this event, the receiver would calculate the minimum rate reduction required to handle 65 carloads (217,000 bushels of corn) in a 10-day period. Unit trains do not come in all sizes. Railroads match a number of cars to a number of engines, depending upon the density of the commodity being moved and the conditions of the track between the origin and the destination. If a route will handle 16 carloads of corn per engine, a 72-car train would require 4½ engines. That is, the railroad could not achieve efficient harmony between power and cars on the fifth power unit attached to the train. Thus, contracting for a unit train may require rigid delivery requirements which would have to be compensated with rate reductions.

The demonstration case assumes the owners of the three feed mills consider continuous contract deliveries of 100, 80, 67 and 50 percent of corn usage, with the remainder of corn coming from local supplies. Frequencies of delivery considered are twice weekly, weekly, 10-day and biweekly service. Tables 8-11 show the annual bushel and carload volumes involved in the various contract options and the bushel and carload volumes per delivery for each of the 16 delivery options, for the group of mills and for each feed mill. Bushels per delivery are calculated as annual corn usage times the portion of usage contracted divided by the number of deliveries per year. For example, the group of three elevators receives 10 million bushels of corn annually. If 80 percent of corn receipts are to be contracted for weekly rail delivery, 8 million bushels would be delivered on contract in 52 equal volumes of 153,846 bushels. At 3,300 bushels per car this would be equivalent to about 47 carloads per week.

Step 2. Market Price Differences

Contracts to haul large volumes of feed materials require material purchases in a limited number of locations with large-volume suppliers. For example, corn to be delivered to North Carolina might be purchased in a place such as Cincinnati or Columbus, Ohio, where large grain terminal companies reside. Prices of feed materials differ between locations. Thus, a receiver may gain or lose on the basic price of materials by changing supplier locations.

Consider corn again. In the southeastern United States, a corn-deficit region, the price of corn tends to be higher than in corn-surplus regions of the Midwest. For feed materials traded on futures market exchanges, the change in market price of materials resulting from a change in purchase location from a local to a distant source is calculated as distant basis minus local basis. Distant basis is the cash price in the location to be named as the rail contract origin, say Cincinnati, minus the futures market price on a nearby contract month. For purposes of evaluating a multi-month rail contract, distant market basis is the average anticipated difference over the life of a contract between the cash price a buyer will pay in Cincinnati and the futures market price. The local basis is the average anticipated difference

Table 8. Optional Contract Volumes and Delivery Schedules for Midwestern Corn: Group

Percent of usage contracted	Annual rail contract volume	Delivery schedule			
		Twice weekly	Weekly	10-Day	Biweekly
		Bushels (Carloads)			
100	10,000,000 (3,030)	96,154 (29)	192,308 (58)	273,973 (83)	384,615 (117)
80	8,000,000 (2,424)	76,923 (23)	153,846 (47)	219,178 (66)	307,692 (93)
67	6,700,000 (2,030)	64,423 (20)	128,846 (39)	183,562 (56)	257,692 (78)
50	5,000,000 (1,515)	48,077 (15)	96,154 (29)	136,986 (42)	192,308 (58)

Table 9. Optional Contract Volumes and Delivery Schedules for Midwestern Corn: Mill A

Percent of usage contracted	Annual rail contract volume	Delivery schedule			
		Twice weekly	Weekly	10-Day	Biweekly
		Bushels (Carloads)			
100	3,500,000 (1,060)	33,654 (10)[t]	67,308 (20)[t]	95,890 (29)[t]	134,615 (41)[t]
80	2,800,000 (848)	26,923 (8)[t]	53,846 (16)[t]	76,712 (23)[t]	107,692 (33)[t]
67	2,345,000 (711)	22,548 (7)	45,096 (14)[t]	64,247 (19)[t]	90,192 (27)[t]
50	1,750,000 (530)	16,827 (5)	33,654 (10)[t]	47,945 (15)[t]	67,308 (20)[t]

t: Track space is limiting; investment is required.

Table 10. Optional Contract Volumes and Delivery Schedules for Midwestern Corn: Mill B

Percent of usage contracted	Annual rail contract volume	Delivery schedule			
		Twice weekly	Weekly	10-Day	Biweekly
		Bushels (Carloads)			
100	5,000,000 (1,515)	48,077 (15)	96,154 (29)[t]	136,986[s] (42)[t]	192,308[s] (58)[tu]
80	4,000,000 (1,212)	38,462 (12)	76,923 (23)	109,589[s] (33)[t]	153,846[s] (47)[tu]
67	3,350,000 (1,015)	32,212 (10)	64,423 (20)	91,781 (28)[t]	128,846[s] (39)[t]
50	2,500,000 (758)	24,038 (7)	48,077 (15)	68,493 (21)	96,154 (29)[t]

s: Storage space is limiting; investment is required.

t: Track space is limiting; investment is required.

u: Unloading capacity is limiting; investment is required.

Table 11. Optional Contract Volumes and Delivery Schedules for Midwestern Corn: Mill C

Percent of usage contracted	Annual rail contract volume	Delivery schedule			
		Twice weekly	Weekly	10-Day	Biweekly
		Bushels (Carloads)			
100	1,500,000 (455)	14,423 (4)	28,846 (9)	41,096 (12)[t]	57,692 (17)[t]
80	1,200,000 (364)	11,538 (3)	23,077 (7)	32,877 (10)	46,154 (14)[t]
67	1,005,000 (305)	9,663 (3)	19,327 (6)	27,534 (8)	38,654 (12)[t]
50	750,000 (227)	7,211 (2)	14,423 (4)	20,548 (6)	28,846 (9)

t: Track space is limiting; investment is required.

over the life of the rail contract between the cash price a buyer will pay in a nearby, local market and the futures market price. Basis changes over time and basis differences change between locations over time. However, basis is less volatile than actual prices.

Historical basis averages can be referred to when estimating basis differences. Historical data do not predict future events, but they do provide a level of magnitude which can be adjusted by individual estimates of future market conditions. Five-year average basis data provide stable basis information since they average the effects of monthly and annual fluctuations in market conditions. Average basis differences reveal what is likely to be gained or lost on the feed material price when contracting for rail service. When evaluating a rail contract with constant shipments throughout the year, the average yearly basis difference is one-twelfth of the sum of monthly basis differences. For example, if the annual average basis lies 10 cents per bushel below the Chicago futures price for the contract origin and 2 cents per bushel over for the local area, the basis difference would be (-10 -2 =) -12 cents per bushel.

Viewing monthly basis differences may permit one to avoid contracting for deliveries when the basis differences are very narrow or unfavorable. For example, during harvest, local grain prices may be low and the advantage of buying at distant locations may be limited to only a portion of the year.

Major grain companies in the Midwest will quote monthly basis figures nearly a year into the future and buyers can contract to guarantee these future basis figures. Future basis quotations help in two ways. First, contracting for basis removes one element of uncertainty about total feed material costs over the life of a railroad contract. Second, future basis quotations can be compared with 5-year average ("normal") basis figures to determine whether contracting basis with the grain company will likely achieve a gain.

When basis quotations do not represent prices at the same stage in the marketing system, basis differences must be adjusted for margin differences: distant margin minus local margin. If the contract origin basis is quoted for corn in a rail car ready to roll to the feed mill, all elevator handling charges are taken into account in the prices quoted FOB contract origin. Thus, no additional margin is necessary for corn at the contract origin. If the local basis is quoted for prices received by farmers, no elevator handling charges are taken into account in these prices. Thus, a standard elevator margin for the area must be added to the local price quotation to account for elevator handling charges, say 20 cents per bushel. The margin difference between the contract origin and the local area is, then, (0 - 20 =) -20 cents per bushel.

The average annual Cincinnati basis for the 5-year period 1976-80 has been 10.4 cents per bushel under the Chicago futures price (see Table 12). The average annual basis for the last 5 years in the example southeastern mill location has been 1.7 cents over the Chicago futures price. Consequently, for a contract covering a full year, one can expect to gain (-10.4 - 1.7 =) 12.1 cents per bushel by buying corn at lower prices in Cincinnati rather than locally.

From the viewpoint of the example feed mills the basis figures presented in Table 12 represent retail prices (FOB origin) for Cincinnati and wholesale prices (farm prices) for local corn. To reconcile the retail-wholesale differences in the basis estimates, a standard elevator margin for the local area of 20 cents per bushel must be added to the local price quotation to account for elevator handling charges. The total market price advantage for buying in Cincinnati is 32.1 cents per bushel.

Step 3. Freight Differences

Next, consider freight charge differences for moving feed materials to the feed mill from alternative locations: distant freight rate minus local freight rate. The existing 3-car rail rate for corn from the contract origin to the feed mill can be obtained from the railroad. Materials from the local region are drawn from an area large enough to supply usage requirements, for example, an area of 100-mile radius. If corn purchases were evenly distributed over the area, the average distance of haul would be 71 miles. With feed trucking rates at $1.25 per road mile the freight bill on an 850-bushel, semi-trailer load would be $177.50, or about 21 cents per bushel. With deregulation of railroads, local rail rates have tended to become much like truck rates

Table 12. Average Corn Basis FOB Cincinnati, Ohio, and Farm Price in Local Area, 1976-80[a]

Delivery month	Futures contract month				
	March	May	July	September	December
			(cents/bushel)		
January	-8 (8)				
February	-5 (11)				
March		-9 (5)			
April		-6 (7)			
May			-5 (10)		
June			-5 (11)		
July				-6 (6)	
August				-10 (-4)	
September					-17 (-24)
October					-25 (-14)
November					-18 (-1)
December	-11 (5)				

[a]Average basis for local farm prices of corn appear in parentheses.

Sources: R. Fledderman, Harris-Crane, Inc., Charlotte, North Carolina, June 1, 1981, and T. E. Nichols, Jr., North Carolina State University, Raleigh, North Carolina, August 6, 1981.

where the rail line configuration permits fairly direct movement between the mill site and elevator locations.

The existing 3-car rail rate for corn from Cincinnati to the example mill locations is 60 cents per bushel (see Table 7). Feed materials from the local region are drawn from an area of about 100-mile radius. Thus, local transport expense is equal to 21 cents per bushel, calculated in the above example. Thus, the freight rate difference between Cincinnati and local corn is approximately (60 - 21 =) 39 cents per bushel.

Step 4. Storage Cost Differences

Costs of storing feed materials include: (a) interest on money tied up in delivered feed, (b) variable costs of operating storage facilities, such as fumigation, power and labor, (c) losses in value due to shrinkage and (d) handling costs of placing materials in and taking them out of storage. If continuous turnover of product is expected, shrinkage would be negligible. Since "in" and "out" costs occur with or without a railroad service contract, this cost item can be ignored.

Variable storage costs are applied to average inventory volumes and interest rates are applied to average inventory value (average inventory volume x average expected delivered price), for a relevant portion of the year. In the simplest case a volume of feed materials arrives just as storage empties and these shipments arrive at continuous, regular intervals throughout the year. In this case, average inventory volume is half the volume of each delivery. Figure 1 illustrates the relationship between delivery schedule and inventory volume, assuming 80 percent of corn shipments to Mill B are on rail contracts (see Table 10). The more frequent are deliveries, the lower are the maximum and average inventories.

When regular shipments continue throughout the year, annual variable storage cost is equivalent to the annual storage cost per bushel per year times average inventory volume. Assuming variable storage cost is 2 cents per bushel per month, or 24 cents per bushel per year, variable storage cost per year for each delivery option is:

24 cents x (½ of delivery volume).

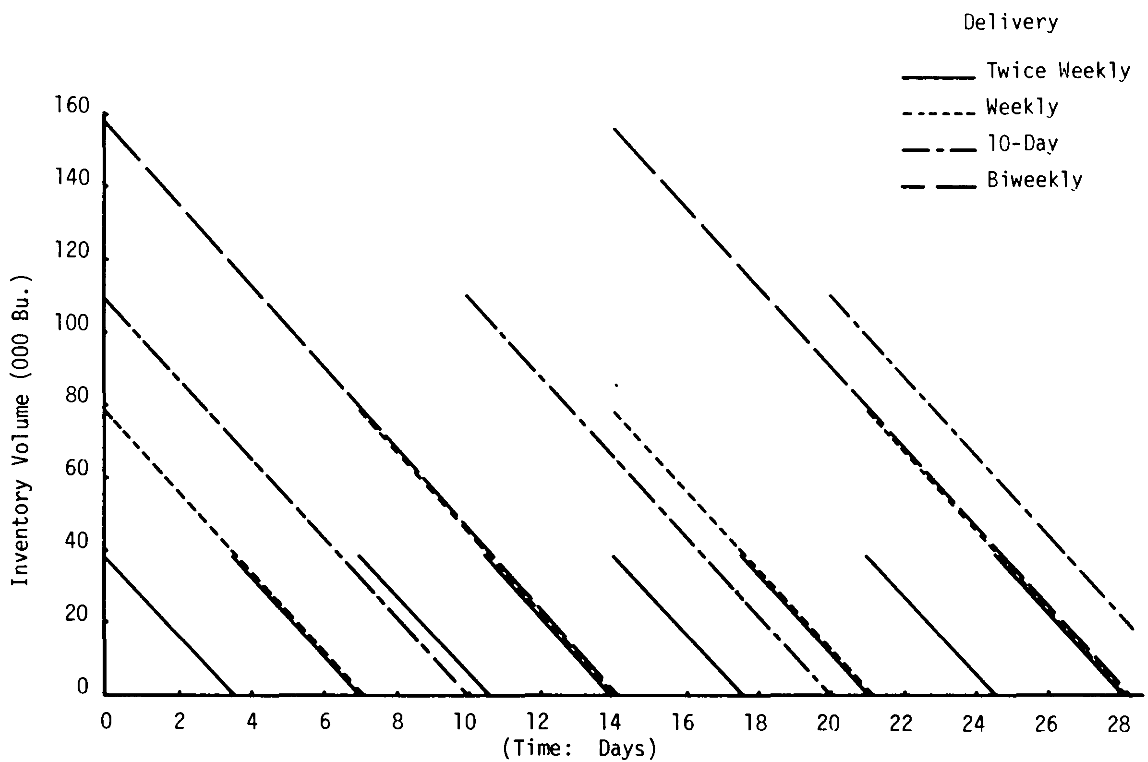


Figure 1. Corn Inventory with Alternative Delivery Schedules

Interest cost of storage requires information on the cost of funds and the expected average delivered price of corn, in addition to average inventory volume. Interest rates are either rates which one must pay to borrow outside funds or which one can obtain by investing inside funds elsewhere, whichever applies to the source of funds used. For example, if one expects to receive an 11 percent return on the use of inside funds (retained earnings), inside funds are valued at 11 percent annually. If one can borrow operating funds at 16 percent, then outside funds are valued at 16 percent. If feed materials are financed with borrowed funds, the 16 percent rate is applied to calculate interest costs; if financed with inside funds, the 11 percent rate is applied.

Expected average corn price is calculated as the expected average base market (Chicago) price adjusted for purchase location and transportation. Assume the group of feed mill managers expects the base market price over a year to be \$2.75 per bushel. If the corn is to be purchased in Cincinnati, the base market price is adjusted for purchase location by subtracting the average Cincinnati basis (-\$.10). Transportation cost from Cincinnati to the local area is \$.60 per bushel. Thus, expected average delivered corn price is \$2.75 (base market price) - \$.10 (basis) + \$.60 (transport) = \$3.25 per bushel.

When regular corn shipments continue throughout the year, total interest cost for storage equals the interest rate times the expected average delivered price times the average inventory. Assuming inside funds could earn 11 percent interest income if they were not tied up in corn inventory and that expected average delivered price is \$3.25 per bushel, total annual interest cost of storage for each delivery option is:

$$0.11 \times \$3.25 \times (\tfrac{1}{2} \text{ of delivery volume}).$$

Storage cost per bushel is obtained by dividing annual facility and interest storage costs by the total number of bushels of corn delivered on the contract, or:

$$\frac{[\$.24 + 0.11(\$3.25)] \times (\tfrac{1}{2} \text{ of delivery volume})}{\text{annual delivery volume}}$$

Interestingly, multiplying by delivery volume and dividing by annual delivery volume is the same as dividing by the turnover rate of inventory, that is, by the number of deliveries. Therefore, storage cost per bushel for each delivery option in this example is:

$$\frac{\$.24 \times 0.11(\$3.25)}{2 \times (\text{Number of deliveries})} = \frac{\$.5975}{2 \times (\text{Number of deliveries})}.$$

So, storage cost per bushel is determined by frequency of delivery rather than volume of delivery. Although the three example mills receive different volumes, each will experience equivalent storage costs per bushel if they contract to receive grain on the same frequency. Storage costs for the four delivery options using the assumed values above are:

Delivery option	Number of deliveries	Storage cost per bushel
Twice weekly	104	$.0029
Weekly	52	.0057
10-day	36.5	.0082
Biweekly	26	.0115

These storage costs per bushel would apply to a contract of any fraction of a year in which corn is delivered with the same frequencies.

Without a rail contract the mills might continue to receive continuous 3-car deliveries of 10,000 bushels. The same method is used to calculate storage cost, but delivery frequencies change depending upon the number of 10,000 bushel units of corn which are consumed at each mill. Using corn utilization data on each mill (Table 7), storage costs without a rail contract are calculated as:

Mill	Corn utilization	Number of deliveries	Storage cost per bushel
A	3,500,000	350	$.0009
B	5,000,000	500	.0006
C	1,500,000	150	.0020

Storage cost differences for each mill are reported in Table 13. For example, storage cost per bushel for grain received weekly on a rail contract is $.0057 and for grain received in regular 3-car shipments for Mill A is $.0009. The storage cost increase attributable to rail contracting is the difference, or $.0048 per bushel.

Table 13. Storage Cost Differences for Example Feed Mills Using Rail Contracting Rather Than 3-Car Shipments

Mill	Delivery schedule			
	Twice weekly	Weekly	10-Day	Biweekly
	(dollars/bushel)			
A	.0020	.0048	.0073	.0106
B	.0023	.0051	.0076	.0109
C	.0009	.0037	.0062	.0095

Step 5. Facility Investment Expenses

Step 5 is the calculation of the facility investment cost per bushel of grain received on contract. Receiving large-volume shipments of feed materials may require additional grain storage space, railroad siding track and grain car unloading capacity. The survey of southeastern poultry feeders suggests that feed mills typically have been designed to receive the 3-car shipment, corresponding to the lowest freight rates previously available. Facility investment differences attributable to a railroad contract are calculated as: contract-related investment cost minus noncontract-related investment cost. Investment costs are calculated on an average, per bushel basis. Assuming no new facilities are required to continue current material receipt patterns, noncontract-related investment costs will be zero.

In Tables 9-11, facility limitations on delivery volumes are noted with superscripts to bushels and cars per delivery. Existing mill facilities are reported in Table 7. A superscript "s" represents a shortage of grain storage space to be able to receive the number of bushels per delivery. The superscript "t" above cars per delivery represents a shortage of track space to receive the relevant number of cars per contract delivery. The superscript "u" above cars per delivery represents a shortage of grain car unloading capacity for the prescribed number of cars per shipment. For example, in Table 9, a shortage of track space is evident for nearly all options. Table 10 shows that Mill B has shortages of storage space, track space and unloading capacity for the highest-volume, least frequent delivery schedules.

Calculating average investment cost per bushel of grain received on a rail contract requires knowledge of the life of the equipment, the interest cost of capital and the volume of grain to be handled in a contract for which the equipment is essential. To illustrate the method of calculation, consider a plan by Mill B to receive 100 percent of their corn in biweekly shipments. Facility adjustments would require an additional 93,000 bushels of storage space, track space for 33 additional rail cars and a second, 5,000 bushel per hour unloading facility.

Extensions of track space are assumed to cost about $40 per foot plus grading and drainage; 50 feet of space are required to place a car.

Thus, track space will cost about $2,000 per unit space. The cost of adding a 5,000 bushel per hour, rail siding unloading system to an existing elevator in North Carolina is estimated to total about $50,000 (see Appendix). It is further assumed that additional grain storage space can be constructed for $2.50 per bushel of space. Consider life of the track and storage space at 20 years and life of the unloading equipment at 10 years. Assume the 16 percent cost of outside capital. Annual corn receipts on the contract are 5,000,000 bushels.

First, investment expenditures are amortized to obtain the annual cost of the investment. This is done by dividing the expenditure by the "present value of an annuity of $1" for the interest rate and life of the asset (found in most interest rate table books). The present value of an annuity of $1 for 10 years at 16 percent is $4.833 and for 20 years at 16 percent is $5.929 (see Table 14). The annual investment cost for track to support 33 additional rail cars in this example would be $2,000 per unit x 33 units ÷ $5.929 = $11,132. The annual investment cost for an additional 93,000 bushels of storage space is $2.50 per unit x 93,000 units ÷ $5.929 = $39,214. The annual investment cost of the unloading system would be $50,000 ÷ $4.833 = $10,346. The total annual investment cost to prepare for the biweekly delivery option is $11,132 + $39,214 + $10,346 = $60,692. Second, this investment cost is divided by receipts of 5,000,000 bushels of corn per year on the contract to obtain an average investment cost per bushel of $.0121.

Table 15 represents the facility investment costs per bushel for upgrading facilities at each mill to receive the level of delivery volumes prescribed for each of the 16 delivery options. All facility investment expenditures for Mills A and C represent investments in rail car track space (Table 15). Facility investment expenditures per bushel for Mill B rise rapidly as contracted volume increases and as frequency of delivery diminishes. This is due to the limitation of expensive corn storage space which must be constructed to accommodate these highest-volume deliveries.

Table 14. Present Worth of an Annuity of $1

Year	Annual interest rate					
	10%	12%	14%	16%	18%	20%
1	0.909	0.893	0.877	0.862	0.847	0.833
2	1.736	1.690	1.647	1.605	1.566	1.528
3	2.487	2.402	2.322	2.246	2.174	2.106
4	3.170	3.037	2.914	2.798	2.690	2.589
5	3.791	3.605	3.433	3.274	3.127	2.991
6	4.355	4.111	3.889	3.685	3.498	3.326
8	5.335	4.968	4.639	4.344	4.078	3.837
10	6.145	5.650	5.216	4.833	4.494	4.193
12	6.814	6.194	5.660	5.197	4.793	4.439
14	7.367	6.628	6.002	5.468	5.008	4.611
16	7.824	6.974	6.265	5.669	5.162	4.730
18	8.201	7.250	6.467	5.818	5.273	4.812
20	8.514	7.469	6.623	5.929	5.353	4.870

Table 15. Facility Investment Expenditures to Accommodate Railroad Contract Deliveries of Corn

Delivery option	Delivery schedule			
	Twice weekly	Weekly	10-Day	Biweekly
	(dollars/bushel)			
Mill A:				
100%	.0003	.0013	.0021	.0033
80%	.0001	.0011	.0019	.0031
67%	.0000	.0010	.0017	.0029
50%	.0000	.0006	.0015	.0025
Mill B:				
100%	.0000	.0003	.0043	.0121
80%	.0000	.0000	.0017	.0101
67%	.0000	.0000	.0003	.0020
50%	.0000	.0000	.0000	.0005
Mill C:				
100%	.0000	.0000	.0004	.0016
80%	.0000	.0000	.0000	.0011
67%	.0000	.0000	.0000	.0007
50%	.0000	.0000	.0000	.0000

Step 6. Quality, Risk and Convenience Premiums

There may be other values of receiving large-volume shipments of feed materials from particular origins rather than receiving small-volume deliveries of local grain. That is, what premium would one pay for Ohio corn delivered in multiple car units over truck deliveries of local grain, after accounting for price, transport, storage and facility investment differences? Recurrent aflatoxin contamination has led some North Carolina swine and poultry feeders to view the quality of North Carolina-produced corn with some skepticism. One poultry feeder said he would pay up to 5 cents per bushel premium for midwestern corn due to quality reliability. Another feeder said that in a year without widespread aflatoxin contamination, he would view corn as corn and pay no premium for midwestern corn. Values of high-volume delivery also may include convenience of receiving feed ingredients less frequently and reducing paperwork. A potential advantage of buying feed ingredients locally is the public relations benefit of participating in the growth and development of the local agricultural economy. These additional values can only be judged by feed mill owners and managers. If premiums are relevant, the premium difference is calculated as: contract-related premium minus noncontract-related premium. No quality, risk or convenience premiums are assumed for the demonstration.

Step 7. Minimum Rate Reductions

The final step in this evaluation is to estimate the minimum rail rate reduction required to make each delivery option at least pay for cost increases associated with rail contracts. Any further rail rate reductions offered in contract negotiations would be considered gains to the feed mills. The minimum rate reduction required to offset contract-related cost increases is calculated for each delivery option by summing the results of Steps 2 through 6 for each option.

For illustration, consider an option by Mill B to contract for delivery of 80 percent of its corn usage for delivery at 10-day intervals. It is evident from Table 12 that the average annual Cincinnati FOB corn price is $.1040 per bushel under the Chicago futures market price (Cincinnati basis - $.1040) and that the average local basis is

$.0170 per bushel over the Chicago futures market price (local basis $.0170). The Cincinnati basis represents a retail corn price to the feed mill and the local basis represents a farm (wholesale) price; therefore, a wholesale-retail basis adjustment is added to the local price equivalent to the typical local elevator handling margin of $.20 per bushel. Next, freight rates are compared. The current 3-car rail rate for corn from Cincinnati is $.60 per bushel; a $.21 per bushel average local freight expense was calculated previously. Therefore, the difference in freight expense is $.39 per bushel. From Table 13, a storage cost difference was calculated to be $.0076 per bushel for this delivery option. This delivery option requires that Mill B receive 33 cars per shipment (Table 10); available track space will hold only 25 cars (Table 7). Therefore, the mill must invest in track construction to hold the additional eight cars. An additional 10,000 bushels of corn storage space also will be required to receive 33-car deliveries. Table 15 shows the average investment cost to make the contract feasible to be $.0017 per bushel received. These comparisons are summarized as follows:

Step	Description	Calculation	Result
2	Cincinnati-Local Basis	-$.1040 - $.0170	-$.1210
	Wholesale-Retail Basis Adjustment	.0000 - .2000	- .2000
3	Cincinnati-Local Freight	.6000 - .2100	.3900
4	Cincinnati-Local Storage	.0082 - .0006	.0076
5	Cincinnati-Local Facilities	.0017 - .0000	.0017
6	Cincinnati-Local Premiums	.0000 - .0000	.0000
7	Minimum Rate Reduction		$.0783

For Mill B to break even in a rail contract for 10-day deliveries of 80 percent of annual corn usage from Cincinnati, a rail rate reduction of at least $.0783 per bushel is necessary. The railroad must offer a rail rate reduction somewhat greater than 7.8 cents per bushel to make this option attractive to Mill B. On the existing rail rate of 60 cents per bushel, the 7.8 cents rate reduction represents a 13 percent rate concession. Thus, the feed mill will want to discuss a 15 to 20 percent rate reduction in return for a guarantee of annual railroad volume from Cincinnati of 4,000,000 bushels of corn to be delivered in 33-car units every 10 days.

The minimum rate reductions for 16 delivery options for each of the example feed mills are shown in Table 16. Note in the table that the delivery option for 80 percent of annual receipts received on a 10-day delivery schedule for Mill B shows a minimum rate reduction of $.0783 per bushel as calculated in the above summary. Minimum rate reductions required by the various firms differ primarily by facility investment costs and somewhat by storage costs. For a group of mills to work cooperatively at designing a railroad service contract, it will be necessary for attractive minimum rate reductions to be similar for each mill. Minimum rate reductions are within a half cent per bushel for the three feed mills for all delivery options for twice weekly, weekly and 10-day deliveries. However, for biweekly deliveries, minimum rate reductions vary up to 1.2 cents per bushel between mills. Consequently, it may be difficult for the three mills to negotiate together for biweekly delivery options.

One of the more viable group options is to negotiate for the permanent dedication of a unit train for corn shipments from Cincinnati. Table 8 shows that if a unit train operated with a 10-day turnaround time, the three feed mills could justify a 65-car unit train (80 percent of usage). A larger train would not leave feed mills much flexibility. A rate reduction of at least 8 cents per bushel (Table 16), or 13 percent off the current 3-car rate is calculated to be attractive to all feed mills in the area. The unit train would have its own permanently assigned power to distribute multiple-car units to each mill and to reassemble the empty train for the return to Cincinnati.

Conclusions and Recommendations

The poultry feeding industry in the southeastern United States has adjusted feed material storage and handling facilities to a rail rate structure which has been in place for more than 15 years. Since 3-car rates for corn and single-car rates for soybeans represent the lowest rail rates available for feed material movement, continuous deliveries in these small volumes have resulted in lowest possible inventory and handling facility cost.

Table 16. Minimum Rate Reductions for Various Rail Contract Delivery Options

Delivery option	Delivery schedule			
	Twice weekly	Weekly	10-Day	Biweekly
	(dollars/bushel)			
Mill A:				
100%	.0713	.0751	.0784	.0829
80%	.0711	.0749	.0782	.0827
67%	.0710	.0748	.0780	.0825
50%	.0710	.0744	.0778	.0821
Mill B:				
100%	.0713	.0744	.0809	.0920
80%	.0713	.0741	.0783	.0900
67%	.0713	.0741	.0769	.0819
50%	.0713	.0741	.0766	.0804
Mill C:				
100%	.0699	.0727	.0756	.0801
80%	.0699	.0727	.0752	.0796
67%	.0699	.0727	.0752	.0792
50%	.0699	.0727	.0752	.0785

Railroad contracting, authorized in the Staggers Rail Act of 1980, offers potentials for greater feed delivery flexibility and lower delivered feed costs. This report presents a method to evaluate the merits of railroad contracting for feed ingredient delivery to poultry feed mills relative to existing delivery patterns and serves as an approach to prepare for rail contract negotiations. The least amounts of rail rate concessions on corn which would be required to leave a group of feed mills no worse off by changing to larger-volume shipments from midwestern origins are calculated. A variety of delivery options and schedules are considered.

The following steps are recommended in the negotiation process with the railroad for a rate and service contract:

(1) evaluate all convenient delivery options carefully to determine the minimum rate reduction required to at least offset added expenses,

(2) when more than one receiver is involved, adopt a workable form of organization among the feed mills, such as a shipper association, to act as the agent for the group in the negotiation and subsequent contracting process, and then

(3) notify the local railroad agent to set up a meeting with representatives in the marketing department to discuss the potential for contracting regular shipments of feed in unit trains or other large-volume units from the Midwest.

Knowledge about the trade-offs between added costs and rate reductions can help grain users negotiate more effectively with the railroad.

APPENDIX

CONSTRUCTING A 5,000 BUSHEL PER HOUR RAILSIDING GRAIN UNLOADING SYSTEM

Appendix Table A-1. Cost Summary

	Rail Siding Unloading System	5,000 BPH
1.	Elevator	$25,000
2.	Drag-Flite Conveyor	9,000
3.	Concrete	8,000
4.	Electrical	8,000
	Date 7-9-81 Total Estimated Cost	$50,000

Appendix Table A-2. Hunter Galvanized Bucket Elevator

(1)	5000 BPH Elevator - 100' D.H.	$13,626.00
(1)	Motor & Drive - 20 HP w/Motor Mount	2,984.00
(90')	Safety Ladder @ 9.50/ft.	855.00
(80')	Safety Cage @ 12.00/ft.	960.00
(1)	Service Platform	865.00
(4)	Rest Platform-Hinged @ 85.00	340.00
(1)	Service Platform Under T.H.	865.00
(1)	Large Boot Hopper	218.00
(1)	Head Cover Wear Liner	190.00
(1)	Head Vent	53.00
(1)	Discharge Transition-Vulcanized 18" to 10"ø	314.00
(3)	Guy Cable Bracket @ 60.00 ea.	180.00
(1)	Flat Back Distributor 10"ø - 6 Hole	1,508.00
(1)	Cable Control (Less Cable)	270.00
(5)	Cable Guide @ 32.00	160.00
(1)	Motor/Drive Guard	85.00
		$23,473.00
	Less 25%	-5,868.00
	Equipment FOB Factory	$17,605.00
	Estimated Freight	+1,200.00
	Equipment Delivered Less Sales Tax	$18,805.00
	Estimated Erection @ 30% of $17,605	+5,280.00
	Total Less Tax	$24,085.00
(1)	16" x 30' lg. Drag-w/10° Elevator Rated @ 5000 BPH-Corn and Including (1) 4' Long By-Pass Feed Inlet	$ 4,703.00
(1)	5 HP-Motor & Drive-TEFC w/Guard	+1,478.00
	Equipment Price FOB Factory	$ 6,181.00
	Estimated Freight	+500.00
	Estimated Installation @ 30%	1,854.00
	Total Less Tax	$ 8,535.00

Concrete Not Included But Estimated At $150/yd.^{3}

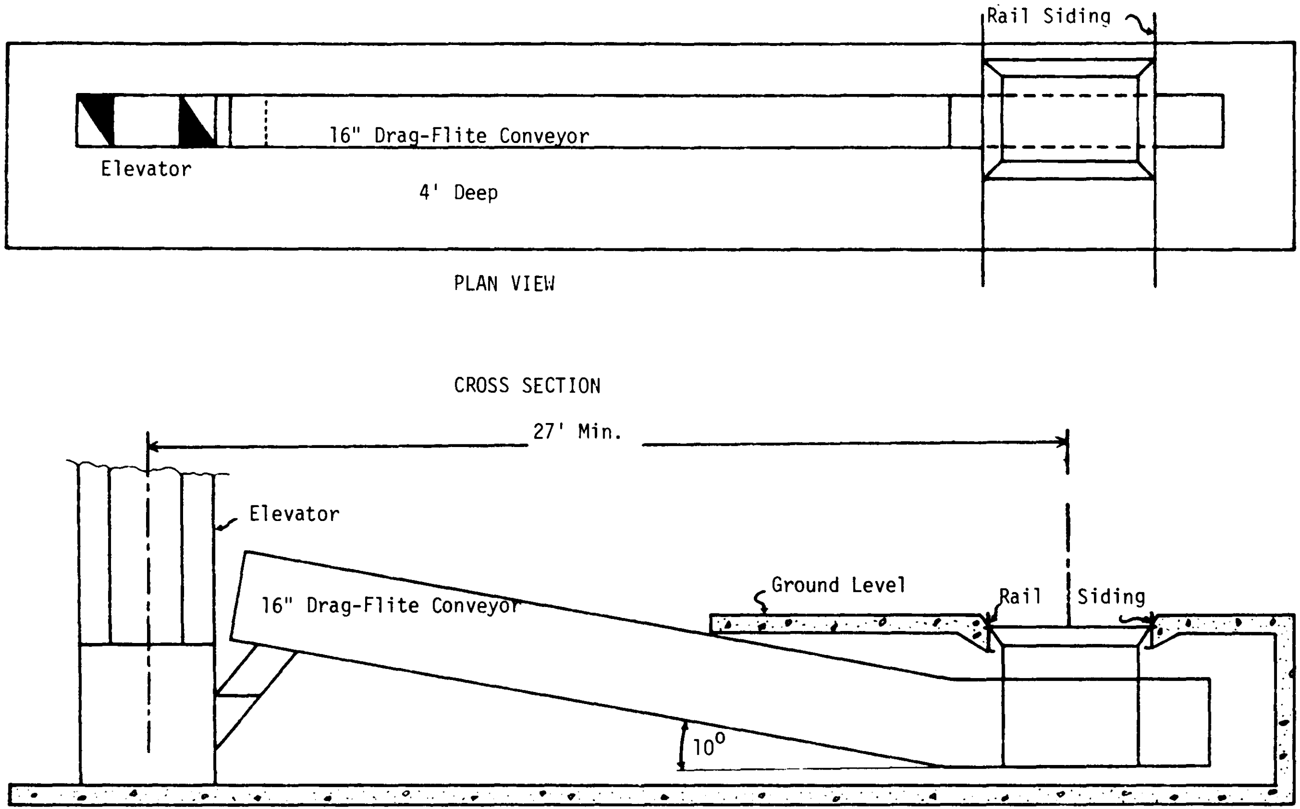
No Electrical Wiring Included

Appendix Table A-3. Concrete

Concrete Volume		
(a) Car unloading surface area		
20 ft. x 100 ft. x .5 ft.	= 1,000 $ft.^3$	= 37.04 $yd.^3$
(b) Pit and elevator area		
6 ft. x 44 ft. x .5 ft.	= 132 $ft.^3$	
2 x 4 ft. x 44 ft. x .5 ft.	= 176 $ft.^3$	
	308 $ft.^3$	= 11.40 $yd.^3$
Total Yards of Concrete		48.44
Estimated Cost @ $150/yd.		$7,266

Appendix Table A-4. Electrical Estimate

Panels and Switches	$3,000
Motor Starters and Conduit	3,000
Wire and Installation	2,000
Total Estimated Cost	$8,000



Appendix Figure A-1. Rail Siding Unloading System - 5,000 BPH (Scale: ¼" = 1'0")

Source: North Carolina Department of Agriculture.

Agricultural Research Service

North Carolina State University
at Raleigh

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