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RETARDERS FOR HEAVY VEHICLES: EVALUATION OF
PERFORMANCE CHARACTERISTICS AND
IN-SERVICE COSTS

Phase I - Appendices

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16. Abstract The potential benefits to be derived from retarder use in heavy truck applications are evaluated in terms of (1) productivity gains due to decreased trip time, (2) cost savings due to decreased brake wear and maintenance, and (3) safety enhancement due to reduced probability of a runaway accident. The physical factors influencing downhill speed control are described and analyzed. The characteristics of currently available retarders are discussed. An assessment of the retarder market and its future potential is presented. An examination of available accident information is employed in developing safety performance analyses of heavy vehicles on downgrade sections of highways. The results of these various studies are applied in summarizing the items that prospective buyers of retarders need to know in order to estimate the cost benefits to be obtained from various levels of retarder power.					
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APPENDIX A

BRAKE TEMPERATURE CHANGES

Equation (1) (below) describes the heat flow process for the foundation brakes in terms of (1) the total energy storage capability of all the brakes, (2) the heat losses due to cooling (convection, radiation, etc.), and (3) the total braking horsepower, HP_B , applied to all the brakes, viz.:

$$(m_B C_P) \frac{dQ}{dt} = HP_B - h(V)(Q - Q_a) \quad (1)$$

where

$m_B C_P$ represents the product of the mass of the brakes multiplied by the specific heat of the brake material (nevertheless, it is an empirically determined coefficient in the application of Equation (1))

Q is the average or bulk temperature of the brakes

$h(V)$ is a cooling coefficient that depends upon velocity

Q_a is the ambient temperature

t is time

$\frac{dQ}{dt}$ is the time rate of change of temperature.

For an initial temperature, Q_0 , the solution to (1) for a constant velocity, V_c , is given by the following equation:

$$Q(t) = Q_0 e^{-t/\tau} + \left(\frac{HP_B}{h(V_c)} + Q_a \right) \left(1 - e^{-t/\tau} \right) \quad (2)$$

where

$$\frac{1}{\tau} = \frac{h(V_c)}{m_B C_P}$$

Empirical results obtained in [2] yield the following expressions for $1/\tau$ and $h(V_c)$ as functions of velocity:

$$\frac{1}{\tau} = 1.23 + 0.256V \text{ mph, } 1/\text{hr} \quad (3)$$

and
$$h(V) = 0.1 + 0.00208V \text{ mph, } \text{hp}/^\circ\text{F} \quad (4)$$

(These expressions (3) and (4) are for a particular tractor-semitrailer vehicle equipped with ten S-cam brakes [2].)

Since $t = L/V_c$ for a fixed grade of length L being traveled at a constant velocity, the temperature, Q_f , at the bottom of the grade may be calculated using (2) with $t = L/V_c$, viz.:

$$Q_f = Q_o e^{-L/V_c \tau} + \left(\frac{HP_B}{h(V_c)} + Q_a \right) \left(1 - e^{-L/V_c \tau} \right) \quad (5)$$

(In [2] the values $Q_f = 425^\circ\text{F}$, $Q_o = 150^\circ\text{F}$, and $Q_a = 90^\circ\text{F}$ are used as standard conditions with 425°F the maximum allowable brake temperature occurring at the bottom of the hill.)

APPENDIX B

RETURN ON INVESTMENT ANALYSES

** HSPI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.
ANTIC. RESALE VALUE (\$)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00	8.00
4 INT. RATE OF RETURN (%)	450.47	450.47	450.47	63.00	450.47	450.47	105.00	50.00	450.47	160.00	77.00	450.47	177.99	77.00	450.47

Retarder Cost: \$450
 Number of Axles: 2
 Vehicle Life: 4 yrs.

** HSRJ ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL												
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL												
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YPS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YPS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.
ANTIC. RESALE VALUE (\$)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	1.30	2.00	2.00	2.00	2.00	4.00	4.00	8.00
INT. RATE OF RETURN (%)	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47
INI. RATE OF RETURN (%)	71.00	33.00	0.0	114.00	63.00	-9.25	162.00	88.00	-9.25	179.99	92.00	-9.25

Retarder Cost: \$450
 Number of Axles: 2
 Vehicle Life: 6 yrs.

** USRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.
ANTIC. RESALE VALUE (%)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00	8.00
INT. RATE OF RETURN (%)	450.47	450.47	450.47	74.00	40.50	5.25	115.00	67.00	15.50	162.00	89.00	18.50	178.99	95.00	18.50

Retarder Cost: \$450
 Number of Axles: 2
 Vehicle Life: 10 yrs.

** 15RI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERNAL LABOR RATE (\$)	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
MINOR SERVICE LEVEL	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRACTOR LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRACTOR PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
TRAILER LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRAILER PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRACTOR YRS IN SERVICE	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	1.00	3.00	1.00	3.00	1.00	3.00	1.00	3.00	1.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.
ANTIC. RESALE VALUE (\$)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
INT. RATE OF RETURN (%)	450.47-450.47	96.00	34.00-450.47	151.00	84.00-450.47	232.99	120.00-450.47	255.99	120.00-450.47	120.00-450.47	120.00-450.47	120.00-450.47

Retarder Cost: \$450
 Number of Axles: 3
 Vehicle Life: 4 yrs.

** 1981 ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	1.00	3.00	0.50	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.
ANTIC. RESALE VALUE (\$)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
EX. FACTOR - MK. LIFE	1.00	1.00	1.00	1.00	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00
INT. RATE OF RETURN (%)	450.47-450.47	450.47-450.47	103.00	60.50	95.00	157.00	9.00	232.99	127.00	9.00	255.99	132.00	9.00

Retarder Cost: \$450
 Number of Axles: 3
 Vehicle Life: 6 yrs.

** LSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL																			

TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL																			

TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	0.50	1.00	3.00	3.00	0.50	1.00	3.00	3.00	0.50	1.00	3.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%) 10.																			
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.
ANTIC. RESALE VALUE (\$)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
EX. FACTOR - W. LIFF	1.00	1.00	1.00	1.00	1.30	1.30	1.30	1.30	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
INIT. RATE OF RETURN (%) - 450.47-450.47-450.47 104.00 64.00 15.00 157.00 96.00 27.50 231.99 127.00 33.00 254.99 133.00 33.00																			

Retarder Cost: \$450
 Number of Axles: 3
 Vehicle Life: 10 yrs.

** USPI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.
ANTIC. RESALE VALUE (\$)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
FX. FACTOR - NP. LIFF	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	2.00	2.00	4.00	8.00
INT. RATE OF RETURN (%)	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47
	133.00	212.99	315.98	105.00-450.47	212.99	315.98	105.00-450.47	212.99	315.98	105.00-450.47	212.99	315.98	105.00-450.47

Retarder Cost: \$450
 Number of Axles: 4
 Vehicle Life: 4 yrs.

** 45RI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERVAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.
ANTIC. RESALE VALUE (\$)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
FX. FACTOR - OP. LIFF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
---INT. RATE OF RETURN (%)---450.47-450.47-450.47 154.00 78.00 22.50 269.99 125.00 17.50 348.98 182.99 17.50 397.98 182.99 17.50													

Retarder Cost: \$450
 Number of Axles: 4
 Vehicle Life: 6 yrs.

** 4SRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.		
INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.		
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.		
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.		
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.		
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.		
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.		
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.		
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.		
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.		
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50		
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.		
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.		
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.		
ANTIC. RESALE VALUE (\$)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
EX. FACTOR - DR. LIFF	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00		
INT. RATE OF RETURN (%)	450.47	450.47	450.47	179.99	103.00	24.00	307.98	170.99	43.50	410.98	210.99	42.00	443.97	220.99	42.00

Retarder Cost: \$450
 Number of Axles: 4
 Vehicle Life: 10 yrs.

** USRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INITIAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MEMOR SERVICE LEVEL											
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL											
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES IN TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.
ANTIC. RESALE VALUE (%)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	2.00	2.00	2.00	2.00	2.00	4.00	8.00
INT. RATE OF RETURN (%)	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47	450.47-450.47
	67.00	165.00	255.99	137.00	450.47	387.98	184.99	450.47	422.98	184.99	450.47

Retarder Cost: \$450
 Number of Axles: 5
 Vehicle Life: 4 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	
INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	
MINOR SERVICE LEVEL														
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	
MAJOR SERVICE LEVEL														
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	
ANTIC. RESALE VALUE (\$)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
EX. FACTOR - MR. LIFE	1.00	1.00	1.00	1.30	1.30	2.00	2.00	2.00	2.00	4.00	4.00	4.00	8.00	
INT. RATE OF RETURN (%)	450.47	450.47	184.99	104.00	29.00	311.98	156.00	28.50	419.98	220.99	28.50	450.47	220.99	28.50

Retarder Cost: \$450
 Number of Axles: 5
 Vehicle Life: 6 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL												
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL												
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%) 10.												
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.	450.
ANTIC. RESALE VALUE (\$)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
EX. FACTOR - BP. LIFE	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	4.00	4.00	8.00
INI. RATE OF RETURN (\$)-450.47-450.47-450.47	210.00	130.00	31.00	348.98	200.99	52.00	450.47	248.99	52.00	450.47	258.99	52.00

Retarder Cost: \$450
 Number of Axles: 5
 Vehicle Life: 10 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.		
INTERNAL LABOR RATE (\$)															
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.		
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.		
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.		
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.		
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.		
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.		
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.		
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.		
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50		
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.		
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.		
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.		
ANTIC. RESALE VALUE (\$)	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.		
FX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	1.30	2.00	2.00	2.00	2.00	4.00	4.00	8.00	8.00		
INT. RATE OF RETURN (%)	-18.25	-18.25	-18.25	-18.25	-6.00	-34.75	57.25	21.00	-34.75	85.50	35.50	-34.75	96.50	35.50	-34.75

Retarder Cost: \$900
 Number of Axles: 2
 Vehicle Life: 4 yrs.

** USRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERPOL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL												
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL												
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.
ANTIC. RESALE VALUE (\$)	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.
EX. FACTOR - BR. LIFE	1.00	1.00	1.30	1.00	1.30	1.00	1.30	1.00	1.30	1.00	1.30	1.00
INT. RATE OF RETURN (%)	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12
		39.25	12.25	-2.75	68.00	31.50	-7.37	90.50	47.50	-7.37	101.00	50.00
												-7.37

Retarder Cost: \$900
 Number of Axles: 2
 Vehicle Life: 6 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	1.00	0.50	1.00	3.00	1.00	0.50	1.00	3.00	1.00	0.50
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.
ANTIC. RESALE VALUE (\$)	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
INT. RATE OF RETURN (%)	44.00	21.50	-0.87	70.25	39.00	5.62	91.50	51.25	2.87	102.00	55.50	2.87	2.87

Retarder Cost: \$900
 Number of Axles: 2
 Vehicle Life: 10 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL												
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL												
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.
ANTIC. RESALE VALUE (\$)	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.
EX. FACTOR - DR. LIFE	1.00	1.00	1.00	1.00	1.30	2.00	2.00	2.00	4.00	4.00	8.00	8.00
INT. RATE OF RETURN (%)	-18.25	-18.25	-18.25	-18.25	84.00	39.00-450.47	125.00	59.50-450.47	140.00	59.50-450.47	140.00	59.50-450.47

Retarder Cost: \$900
 Number of Axles: 3
 Vehicle Life: 4 yrs.

** USRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERNAL LABOR RATE (\$)	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
MINOR SERVICE LEVEL	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRACTOR LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRACTOR PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
TRAILER LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRAILER PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YPS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.
ANTIC. RESALE VALUE (\$)	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
INT. RATE OF RETURN (%)	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12	-23.12
	57.50	25.7	2.87	93.50	49.50	-0.12	128.00	69.75	-0.12	142.50	73.50	-0.12		

Retarder Cost: \$900
 Number of Axles: 3
 Vehicle Life: 6 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	1.00	0.50	1.00	3.00	3.00	0.50	1.00	3.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.
ANTIC. RESALE VALUE (\$)	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
INT. RATE OF RETURN (%)	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47
	61.00	33.50	6.00	94.50	55.00	14.50	128.50	72.00	16.25	142.50	77.25	16.25	16.25

Retarder Cost: \$900
 Num-er of Axles: 3
 Vehicle Life: 10 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR LABOR HOURS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER LABOR HOURS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR LABOR HOURS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER LABOR HOURS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.
ANTIC. RESALE VALUE (\$)	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
INT. RATE OF RETURN (%)	-18.25	-18.25	-18.25	68.50	9.25-450.47	115.00	50.50-450.47	166.00	73.50-450.47	183.99	73.50-450.47	73.50-450.47	73.50-450.47

Retarder Cost: \$900
 Number of Axles: 4
 Vehicle Life: 4 yrs.

** ISRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERNAL LABOR RATE (\$)	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.
MINOR SERVICE LEVEL														
TRACTOR LABOR HOURS	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.
TRACTOR PARTS (\$)	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.
TRAILER LABOR HOURS	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.
TRAILER PARTS (\$)	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.
MAJOR SERVICE LEVEL														
TRACTOR LABOR HOURS	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.
TRACTOR PARTS (\$)	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.
TRAILER LABOR HOURS	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.
TRAILER PARTS (\$)	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.
TRACTOR YRS IN SERVICE	6.	2.	2.	0.50	6.	2.	2.	0.50	6.	2.	2.	0.50	6.	2.
AXLES ON TRACTOR	2.	2.	2.	3.00	2.	2.	2.	3.00	2.	2.	2.	3.00	2.	2.
AXLES ON TRAILER	2.	2.	2.	3.00	2.	2.	2.	3.00	2.	2.	2.	3.00	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	1.00	3.00	0.50	1.00	1.00	3.00	0.50	1.00	1.00	3.00	0.50	1.00
DISC RATE - NEW INVEST. (%) 10.														
TAX FACTOR ON EARNINGS	46.	7.	10.	46.	46.	7.	10.	46.	46.	7.	10.	46.	46.	7.
INVEST. TAX CREDIT (%)	7.	10.	10.	7.	7.	10.	10.	7.	7.	10.	10.	7.	7.	10.
INFLATION RATE (%/YR)	10.	900.	342.	1.00	10.	900.	342.	1.00	10.	900.	342.	1.00	10.	900.
INSTALLED \$ OF BRAKE	900.	342.	1.00	900.	900.	342.	1.00	900.	900.	342.	1.00	900.	900.	342.
ANTIC. RESALE VALUE (\$)	342.	1.00	1.00	342.	342.	1.00	1.00	342.	342.	1.00	1.00	342.	342.	1.00
EX. FACTOR - DR. LIFE	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
INT. RATE OF RETURN (%)	-23.12	-23.12	-23.12	-23.12	82.00	65.00	146.50	65.00	4.50	182.99	97.50	4.50	210.99	98.00

Retarder Cost: \$900
 Number of Axles: 4
 Vehicle Life: 6 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	
MINOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	
TRAILER LABOR HOURS	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	
TRACTOR PARTS (\$)	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	
TRAILER LABOR HOURS	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	
TRACTOR PARTS (\$)	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	
DISC RATE - NEW INVEST. (%) 10.													
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	
ANTIC. RESALE VALUE (\$)	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	
EX. FACTOR - DR. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
INT. RATE OF RETURN (%)	450.47-450.47-450.47	96.50	52.00	10.25	165.00	90.00	22.75	213.99	112.00	20.25	232.99	118.50	20.25

Retarder Cost: \$900
 Number of Axles: 4
 Vehicle Life: 10 yrs.

** HSRI ECCNOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL												
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL												
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.
ANTIC. RESALE VALUE (\$)	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.	468.
EX. FACTOR - DR. LIFE	1.00	1.00	1.00	1.30	1.30	1.30	1.30	2.00	2.00	2.00	4.00	8.00
INT. RATE OF RETURN (%)	-18.25	-18.25	-18.25	20.00-450.47	139.00	67.00-450.47	203.99	95.00-450.47	224.99	95.00-450.47	224.99	95.00-450.47

Retarder Cost: \$900
 Number of Axles: 5
 Vehicle Life: 4 yrs.

** 45RI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.			
INTERNAL LABOR RATE (\$)															
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.			
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.			
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.			
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.			
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.			
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.			
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.			
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.			
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.			
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.			
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.			
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	0.50	3.00			
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.			
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.			
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.			
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.			
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.			
ANTIC. RESALE VALUE (\$)	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.			
EX. FACTOR - DP. LIFE	1.00	1.00	1.00	1.30	1.30	2.00	2.00	2.00	4.00	4.00	8.00	8.00			
INT. RATE OF RETURN (%)	-23.12	-23.12	-23.12	98.50	48.00	14.25	169.99	81.50	10.50	219.99	118.00	10.50	250.99	119.00	10.50

Retarder Cost: \$900
 Number of Axles: 5
 Vehicle Life: 6 yrs.

** 15RI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.	900.
ANTIC. RESALE VALUE (\$)	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.	171.
EX. FACTOR - BP. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
INT. RATE OF RETURN (%)	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47	450.47
	63.50	15.62	187.99	105.50	29.00	250.99	132.00	28.75	272.99	139.00	28.75	272.99	139.00

Retarder Cost: \$900
 Number of Axles: 5
 Vehicle Life: 10 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	
MINOR SERVICE LEVEL														
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	
MAJOR SERVICE LEVEL														
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	
INSTALLED \$ OF BRAKE	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	
ANTIC. RESALE VALUE (\$)	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.	
EX. FACTOR - NF. LIFE	1.00	1.00	1.00	1.00	1.30	2.00	2.00	2.00	2.00	4.00	4.00	4.00	8.00	
INT. RATE OF RETURN (%)	-14.50	-14.50	-14.50	-14.50	12.50	-9.00	-17.94	27.87	5.25	-17.94	43.25	12.75	-17.94	12.75

Retarder Cost: \$1800
 Number of Axles: 2
 Vehicle Life: 4 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.
ANTIC. RESALE VALUE (\$)	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.
EX. FACTOR - BP. LIFE	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00	8.00
INT. RATE OF RETURN (%)	-16.22	-16.22	-16.22	19.25	1.37	-6.12	39.12	12.87	-9.12	49.87	23.75	-9.12	56.62	24.62	-9.12

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Retarder Cost: \$1800
 Number of Axles: 2
 Vehicle Life: 6 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.			
MINOR SERVICE LEVEL																
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.			
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.			
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.			
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.			
MAJOR SERVICE LEVEL																
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.			
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.			
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.			
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.			
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.			
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.			
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.			
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50			
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.			
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.			
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.			
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.			
INSTALLED \$ OF BRAKE	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.			
ANTIC. RESALE VALUE (\$)	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.			
EX. FACTOR - RP. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
INT. RATE OF RETURN (%)	-113.62	-113.62	-113.62	-28.50	25.44	10.12	-5.62	43.12	22.44	-1.19	53.75	29.50	-9.75	59.50	32.25	-9.75

Retarder Cost: \$1800
 Number of Axles: 2
 Vehicle Life: 10 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	
INTERNAL LABOR RATE (\$)	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.
MINOR SERVICE LEVEL																
TRACTOR LABOR HOURS	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.
TRACTOR PARTS (\$)	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.
TRAILER LABOR HOURS	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.
TRAILER PARTS (\$)	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.
MAJOR SERVICE LEVEL																
TRACTOR LABOR HOURS	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.
TRACTOR PARTS (\$)	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.
TRAILER LABOR HOURS	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.
TRAILER PARTS (\$)	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.
TRACTOR YRS IN SERVICE	4.	3.	0.	0.50	4.	3.	0.	0.50	4.	3.	0.	0.50	4.	3.	0.	0.50
AXLES ON TRACTOR	3.	0.	0.	3.00	3.	0.	0.	3.00	3.	0.	0.	3.00	3.	0.	0.	3.00
AXLES ON TRAILER	0.	1.00	1.00	10.	0.	1.00	1.00	10.	0.	1.00	1.00	10.	0.	1.00	1.00	10.
YRS TO BRAKE OVERHAUL	0.50	10.	46.	7.	10.	46.	7.	10.	46.	7.	10.	46.	7.	10.	46.	7.
DISC RATE - NEW INVEST. (%)	10.	46.	7.	10.	10.	46.	7.	10.	10.	46.	7.	10.	10.	46.	7.	10.
TAX FACTOR ON EARNINGS	46.	7.	10.	1800.	46.	7.	10.	1800.	46.	7.	10.	1800.	46.	7.	10.	1800.
INVEST. TAX CREDIT (%)	7.	10.	1800.	936.	7.	10.	1800.	936.	7.	10.	1800.	936.	7.	10.	1800.	936.
INFLATION RATE (%/YR)	10.	1800.	936.	1.00	10.	1800.	936.	1.00	10.	1800.	936.	1.00	10.	1800.	936.	1.00
INSTALLED \$ OF BRAKE	1800.	936.	1.00	14.50	1800.	936.	1.00	14.50	1800.	936.	1.00	14.50	1800.	936.	1.00	14.50
ANTIC. RESALE VALUE (\$)	936.	1.00	14.50	23.37	936.	1.00	14.50	23.37	936.	1.00	14.50	23.37	936.	1.00	14.50	23.37
EX. FACTOR - BR. LIFE	1.00	14.50	23.37	-14.50	1.00	14.50	23.37	-14.50	1.00	14.50	23.37	-14.50	1.00	14.50	23.37	-14.50
INT. RATE OF RETURN (%)	-14.50	23.37	-14.50	23.37	-14.50	23.37	-14.50	23.37	-14.50	23.37	-14.50	23.37	-14.50	23.37	-14.50	23.37

Retarder Cost: \$1800
 Number of Axles: 3
 Vehicle Life: 4 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERNAL LABOR RATE (\$)	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
MINOR SERVICE LEVEL	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRACTOR LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRACTOR PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
TRAILER LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRAILER PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
AXLES ON TRACTOR	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
AXLES ON TRAILER	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	1.00	3.00	1.00	3.00	1.00	3.00	1.00	3.00	1.00
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.
ANTIC. RESALE VALUE (\$)	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00
INT. RATE OF RETURN (%)	-16.22	-16.22	-16.22	30.87	55.37	23.87	-5.69	71.75	37.37	-5.69	80.50	39.12
												-5.69

Retarder Cost: \$1800
 Number of Axles: 3
 Vehicle Life: 6 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERNAL LABOR RATE (\$)	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.
MINOR SERVICE LEVEL																		
TRACTOR LABOR HOURS	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.
TRACTOR PARTS (\$)	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.
TRAILER LABOR HOURS	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.
TRAILER PARTS (\$)	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.	175.	4.	160.	5.
MAJOR SERVICE LEVEL																		
TRACTOR LABOR HOURS	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.
TRACTOR PARTS (\$)	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.
TRAILER LABOR HOURS	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.
TRAILER PARTS (\$)	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.	290.	5.	275.	6.
TRACTOR YRS IN SERVICE	10.	3.	0.	0.50	10.	3.	0.	0.50	10.	3.	0.	0.50	10.	3.	0.	0.50	10.	3.
AXLES ON TRACTOR	3.	0.	0.	3.00	3.	0.	0.	3.00	3.	0.	0.	3.00	3.	0.	0.	3.00	3.	0.
AXLES ON TRAILER	0.	1.00	1.00	0.50	0.	1.00	1.00	0.50	0.	1.00	1.00	0.50	0.	1.00	1.00	0.50	0.	1.00
YRS TO BRAKE OVERHAUL	0.50	1.00	1.00	0.50	0.50	1.00	1.00	0.50	0.50	1.00	1.00	0.50	0.50	1.00	1.00	0.50	0.50	1.00
DISC. RATE - NEW INVEST. (%)	10.	46.	7.	10.	10.	46.	7.	10.	10.	46.	7.	10.	10.	46.	7.	10.	10.	46.
TAX FACTOR ON EARNINGS	46.	7.	10.	10.	46.	7.	10.	10.	46.	7.	10.	10.	46.	7.	10.	10.	46.	7.
INVEST. TAX CREDIT (%)	7.	10.	10.	10.	7.	10.	10.	10.	7.	10.	10.	10.	7.	10.	10.	10.	7.	10.
INFLATION RATE (%/YR)	10.	1800.	342.	1.00	10.	1800.	342.	1.00	10.	1800.	342.	1.00	10.	1800.	342.	1.00	10.	1800.
INSTALLED \$ OF BRAKE	1800.	342.	1.00	1.30	1800.	342.	1.00	1.30	1800.	342.	1.00	1.30	1800.	342.	1.00	1.30	1800.	342.
ANTIC. RESALE VALUE (\$)	342.	1.00	1.00	1.30	342.	1.00	1.00	1.30	342.	1.00	1.00	1.30	342.	1.00	1.00	1.30	342.	1.00
FX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	1.00	1.00	1.00	1.30	1.00	1.00	1.00	1.30	1.00	1.00	1.00	1.30	1.00	1.00
INT. RATE OF RETURN (%)	-113.62	-113.62	-28.50	36.37	-113.62	-113.62	-28.50	36.37	-113.62	-113.62	-28.50	36.37	-113.62	-113.62	-28.50	36.37	-113.62	-113.62

Retarder Cost: \$1800
 Number of Axles: 3
 Vehicle Life: 10 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.
ANTIC. RESALE VALUE (\$)	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00	8.00
INT. RATE OF RETURN (%)	-14.50	-14.50	-14.50	33.00	-2.12	-22.75	59.75	21.25	-22.75	86.75	34.00	-22.75	97.00	34.00	-22.75

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Retarder Cost: \$1800
 Number of Axles: 4
 Vehicle Life: 4 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERMIAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.		
MINOR SERVICE LEVEL														
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.		
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.		
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.		
MAJOR SERVICE LEVEL														
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.		
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.		
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.		
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.		
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.		
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.		
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	1.00	3.00	1.00	3.00	1.00	3.00	1.00	3.00	1.00		
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.		
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.		
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
INSTALLED \$ OF BRAKE	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.		
ANTIC. RESALE VALUE (\$)	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.		
EX. FACTOR - DR. LIFE	1.00	1.00	1.00	1.00	1.30	2.00	2.00	2.00	2.00	4.00	4.00	8.00		
INT. RATE OF RETURN (%)	-16.22	-16.22	-16.22	-16.22	43.25	14.25	1.37	80.75	32.25	-3.00	98.25	51.75	-3.00	
													113.50	
														51.75
														-3.00

Retarder Cost: \$1800
 Number of Axles: 4
 Vehicle Life: 6 yrs.

** HSPI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.
ANTIC. RESALE VALUE (\$)	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.
FX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00	8.00
INT. RATE OF RETURN (%)	-113.62	-113.62	-28.50	53.50	27.00	1.37	91.25	49.62	9.44	114.50	61.25	5.12	125.00	65.37	5.12

Retarder Cost: \$1800
 Number of Axles: 4
 Vehicle Life: 10 yrs.

** ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.					
MINOR SERVICE LEVEL																
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.					
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.					
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.					
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.					
MAJOR SERVICE LEVEL																
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.					
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.					
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.					
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.					
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.					
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.					
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.					
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	1.00	3.00	3.00	1.00	3.00	3.00	1.00					
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.					
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.					
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.					
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.					
INSTALLED \$ OF BRAKE	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.					
ANTIC. RESALE VALUE (\$)	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.	936.					
FX. FACTOR - RR. LIFE	1.00	1.00	1.00	1.30	2.00	2.00	2.00	2.00	2.00	4.00	8.00					
INT. RATE OF RETURN (%)	-14.50	-14.50	-14.50	-14.50	42.75	1.62	-26.75	74.25	30.00	-26.75	107.50	45.75	-26.75	120.00	45.75	-26.75

Retarder Cost: \$1800
 Number of Axles: 5
 Vehicle Life: 4 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERNAL LABOR RATE (\$)	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
MINOR SERVICE LEVEL	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRACTOR LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRACTOR PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR LABOR HOURS	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRACTOR PARTS (\$)	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER LABOR HOURS	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRAILER PARTS (\$)	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR YRS IN SERVICE	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
YRS TO BRAKE OVERHAUL	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.
ANTIC. RESALE VALUE (\$)	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.	684.
EX. FACTOR - DR. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
INT. RATE OF RETURN (%)	-16.22	-16.22	-16.22	-16.22	-16.22	-16.22	-16.22	-16.22	-16.22	-16.22	-16.22	-16.22	-16.22
	4.31	94.75	41.75	0.12	118.50	63.50	0.12	135.50	64.25	0.12	135.50	64.25	0.12

Retarder Cost: \$1800
 Number of Axles: 5
 Vehicle Life: 6 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.	1800.
ANTIC. RESALE VALUE (\$)	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.	342.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
INT. RATE OF RETURN (%)	-113.62	-113.62	-28.50	62.75	33.31	5.25	104.75	58.00	14.19	134.00	72.25	12.00	146.50
												77.00	12.00

Retarder Cost: \$1800
 Number of Axles: 5
 Vehicle Life: 10 yrs.

** ISRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.
ANTIC. RESALE VALUE (\$)	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00	8.00
INT. RATE OF RETURN (%)	-12.78	-12.78	-12.78	1.94	-10.09	-14.19	10.94	-2.56	-14.19	19.50	1.28	-14.19	23.00	1.28	-14.19

Retarder Cost: \$3500
 Number of Axles: 2
 Vehicle Life: 4 yrs.

** ISRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.

MINOR SERVICE LEVEL															

TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.

MAJOR SERVICE LEVEL															

TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	5.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.
ANTIC. RESALE VALUE (\$)	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00	8.00
INT. RATE OF RETURN (%)	-13.37	-13.37	-13.37	7.00	-4.22	-8.09	20.72	2.31	-9.91	26.06	9.66	-9.91	30.62	9.62	-9.91

Retarder Cost: \$3500
 Number of Axles: 2
 Vehicle Life: 6 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.		
MINOR SERVICE LEVEL																
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.		
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.		
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.		
MAJOR SERVICE LEVEL																
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.		
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.		
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.		
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.		
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	1.00	1.00	3.00	3.00	1.00	1.00	3.00	3.00	1.00	3.00		
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.		
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.		
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.		
ANTIC. RESALE VALUE (\$)	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.		
EX. FACTOR - IMP. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.30	1.30	1.00	1.00	1.30	1.30	1.00	1.00		
INT. RATE OF RETURN (%)	-25.25	-25.25	-25.25	-19.25	13.31	2.47	-8.78	25.97	11.56	-5.77	31.87	15.81	-12.37	35.37	17.53	-12.37

Retarder Cost: \$3500
 Number of Axles: 2
 Vehicle Life: 10 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
MINOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50
DISC. RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.
ANTIC. RESALE VALUE (\$)	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
INT. RATE OF RETURN (%)	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78
	8.31	-8.56	-14.97	20.81	2.31	-14.97	33.00	8.12	-14.97	38.00	8.12	-14.97	8.12

Retarder Cost: \$3500
 Number of Axles: 3
 Vehicle Life: 4 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	
MINOR SERVICE LEVEL													
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	
MAJOR SERVICE LEVEL													
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	1.00	3.00	1.00	3.00	1.00	3.00	1.00	3.00	1.00	
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	
ANTIC. RESALE VALUE (\$)	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	2.00	2.00	2.00	2.00	2.00	4.00	4.00	8.00	
INT. RATE OF RETURN (%)	-13.37	-13.37	-13.37	-5.94	31.62	8.94	-8.16	39.75	18.19	-8.16	45.50	18.69	-8.16

Retarder Cost: \$3500
 Number of Axles: 3
 Vehicle Life: 6 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.		
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.		
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.		
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.		
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.		
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.		
TRAILER LABCR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.		
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.		
AXLES ON TRAILER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.		
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	0.50	1.00	3.00	3.00	0.50	1.00	3.00	3.00	0.50		
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.		
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.		
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.		
ANTIC. RESALE VALUE (\$)	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.		
EX. FACTOR - DR. LIFE	1.00	1.00	1.00	1.00	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00		
INT. RATE OF RETURN (%)	-25.25	-25.25	-19.25	20.94	7.97	-5.47	36.22	18.53	-1.30	44.50	24.25	-5.47	49.25	26.50	-5.47

Retarder Cost: \$3500
 Number of Axles: 3
 Vehicle Life: 10 yrs.

** IISRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	
MINOR SERVICE LEVEL																
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	
MAJOR SERVICE LEVEL																
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	
ANTIC. RESALE VALUE (\$)	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	
EX. FACTOR - NR. LIFE	1.00	1.00	1.00	1.30	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00	8.00	
INT. RATE OF RETURN (%)	-12.78	-12.78	-12.78	13.50	-6.81	-16.06	29.25	6.12	-16.06	44.25	13.06	-16.06	50.12	13.06	-16.06	

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Retarder Cost: \$3500
 Number of Axles: 4
 Vehicle Life: 4 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.			
INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.			
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.			
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.			
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.			
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.			
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.			
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.			
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.			
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.			
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.			
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.			
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.			
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00			
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.			
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.			
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.			
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.			
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.			
ANTIC. RESALE VALUE (\$)	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.			
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	2.00	2.00	2.00	2.00	2.00	4.00	8.00	8.00			
INT. RATE OF RETURN (%)	-13.37	-13.37	-13.37	21.25	2.97	-3.72	44.75	13.78	-6.75	53.62	26.19	-6.75	62.50	25.81	-6.75

Retarder Cost: \$3500
 Number of Axles: 4
 Vehicle Life: 6 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.		
MINOR SERVICE LEVEL														
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.		
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.		
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.		
MAJOR SERVICE LEVEL														
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.		
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.		
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.		
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
AXLES ON TRACTOR	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.		
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.		
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00		
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.		
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.		
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.		
ANTIC. RESALE VALUE (\$)	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.		
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.30	2.00	2.00	2.00	2.00	2.00	4.00	4.00	8.00		
INT. RATE OF RETURN (%)	-25.25	-25.25	-25.25	-19.25	30.00	13.06	-4.44	52.81	27.94	0.91	64.62	34.44	-4.34	
													70.37	
														37.00
														-4.34

Retarder Cost: \$3500
 Number of Axles: 4
 Vehicle Life: 10 yrs.

** 4SRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERNAL LABOR RATE (\$)												
MINOR SERVICE LEVEL												
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL												
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	0.50	1.00	3.00	3.00	0.50	1.00	3.00	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.
ANTIC. RESALE VALUE (\$)	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.	1820.
EX. FACTOR - DR. LIFE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
INIT. RATE OF RETURN (%)	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78	-12.78
	19.31	19.31	19.31	19.31	19.31	19.31	19.31	19.31	19.31	19.31	19.31	19.31
	-5.19	-17.00	38.06	10.81	-17.00	56.50	19.50	-17.00	63.62	19.50	-17.00	-17.00

Retarder Cost: \$3500
 Number of Axles: 5
 Vehicle Life: 4 yrs.

** HSRI ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
INTERNAL LABOR RATE (\$)														
MINOR SERVICE LEVEL														
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.
MAJOR SERVICE LEVEL														
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.
TRACTOR YRS IN SERVICE	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	1.00	3.00	0.50	3.00
DISC RATE - NEW INVEST. (%)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.
ANTIC. RESALE VALUE (\$)	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.	1330.
EX. FACTOR - BR. LIFE	1.00	1.00	1.00	1.00	1.30	1.30	2.00	2.00	2.00	4.00	4.00	4.00	8.00	8.00
INT. RATE OF RETURN (%)	-13.37	-13.37	-13.37	-13.37	6.72	-1.84	53.87	19.62	-5.06	65.62	33.50	-5.06	75.62	33.56
														-5.06

Retarder Cost: \$3500
 Number of Axles: 5
 Vehicle Life: 6 yrs.

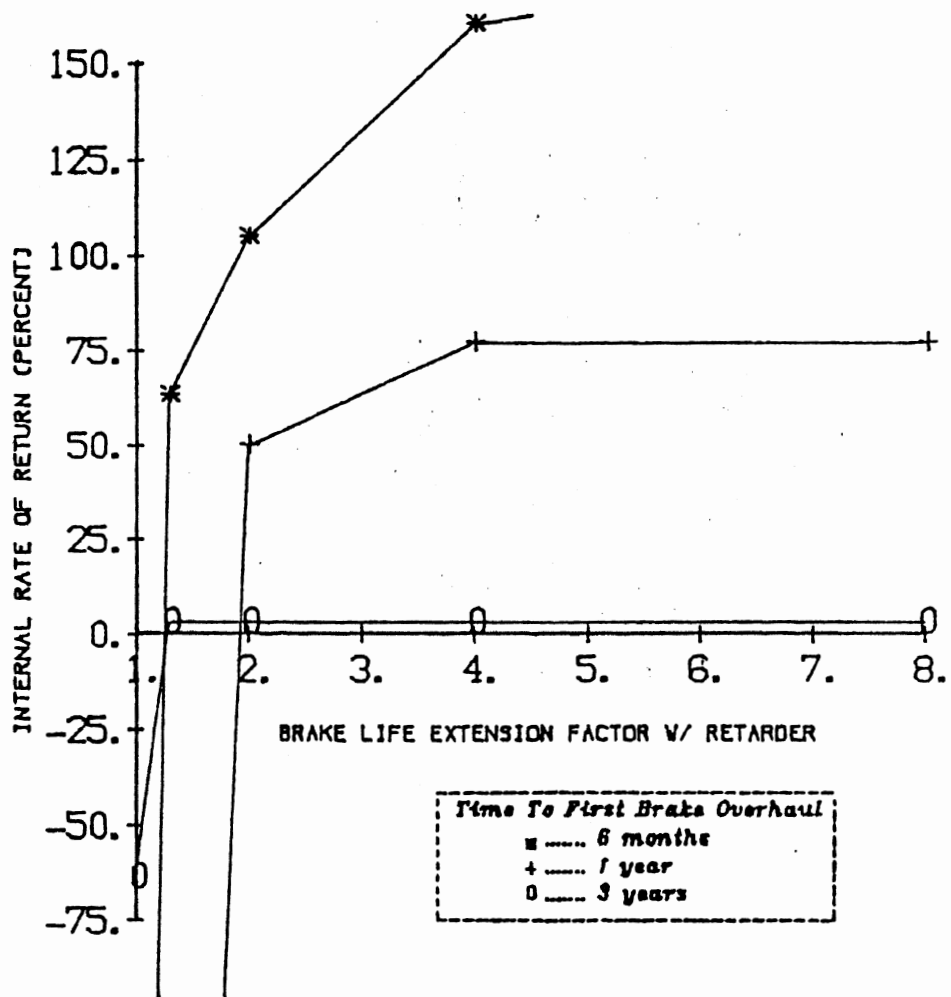
** HSR ECONOMIC ANALYSIS FOR RETARDER PROJECT **

	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.		
INTERNAL LABOR RATE (\$)	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.		
MINOR SERVICE LEVEL															
TRACTOR LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRACTOR PARTS (\$)	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.	175.		
TRAILER LABOR HOURS	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.		
TRAILER PARTS (\$)	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.	160.		
MAJOR SERVICE LEVEL															
TRACTOR LABOR HOURS	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.	6.		
TRACTOR PARTS (\$)	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.	290.		
TRAILER LABOR HOURS	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.		
TRAILER PARTS (\$)	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.	275.		
TRACTOR YRS IN SERVICE	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
AXLES ON TRACTOR	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.		
AXLES ON TRAILER	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.		
YRS TO BRAKE OVERHAUL	0.50	1.00	3.00	3.00	0.50	1.00	3.00	3.00	0.50	1.00	3.00	3.00	3.00		
DISC RATE - NEW INVEST. (%) 10.															
TAX FACTOR ON EARNINGS	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.	46.		
INVEST. TAX CREDIT (%)	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.		
INFLATION RATE (%/YR)	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.		
INSTALLED \$ OF BRAKE	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.	3500.		
AMTIC. RESALE VALUE (\$)	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.	665.		
EX. FACTOR - DR. LIFE	1.00	1.00	1.00	1.30	2.00	2.00	2.00	2.00	4.00	4.00	4.00	4.00	8.00		
INT. RATE OF RETURN (%)	-25.25	-25.25	-19.25	36.06	17.28	-1.66	61.31	33.31	4.44	75.75	41.31	0.53	82.87	44.31	0.53

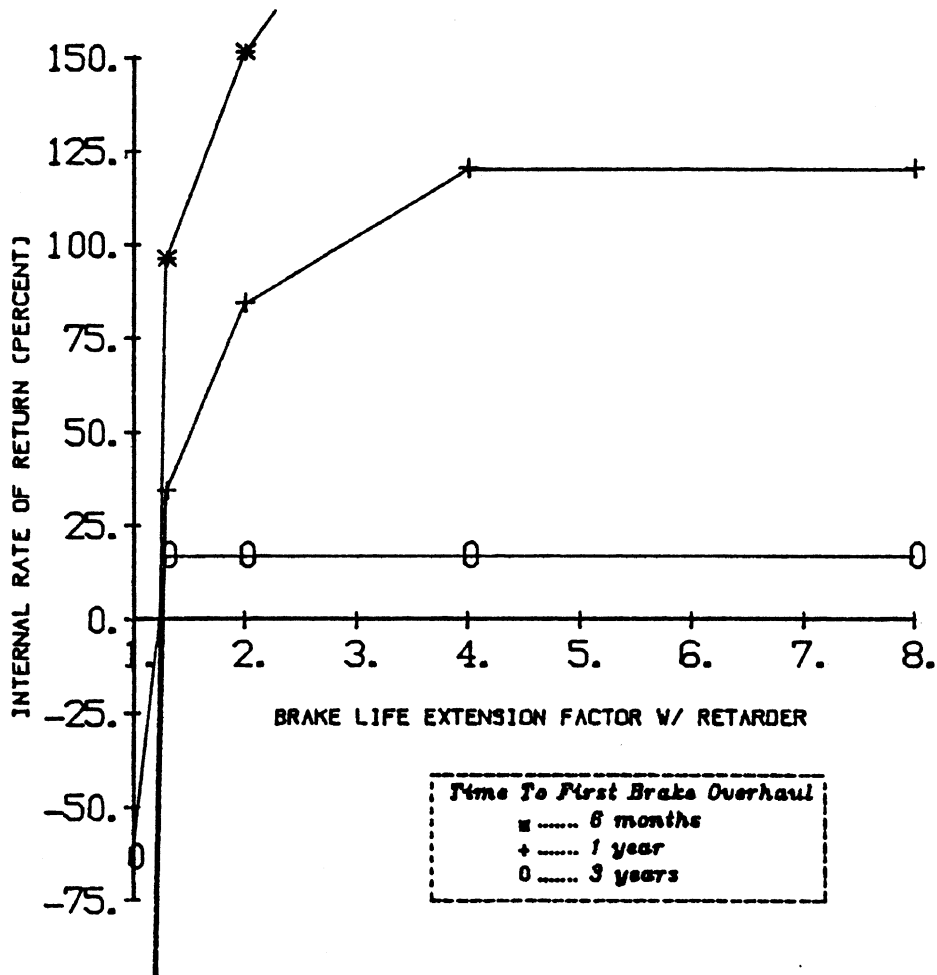
Retarder Cost: \$3500
 Number of Axles: 5
 Vehicle Life: 10 yrs.

APPENDIX C

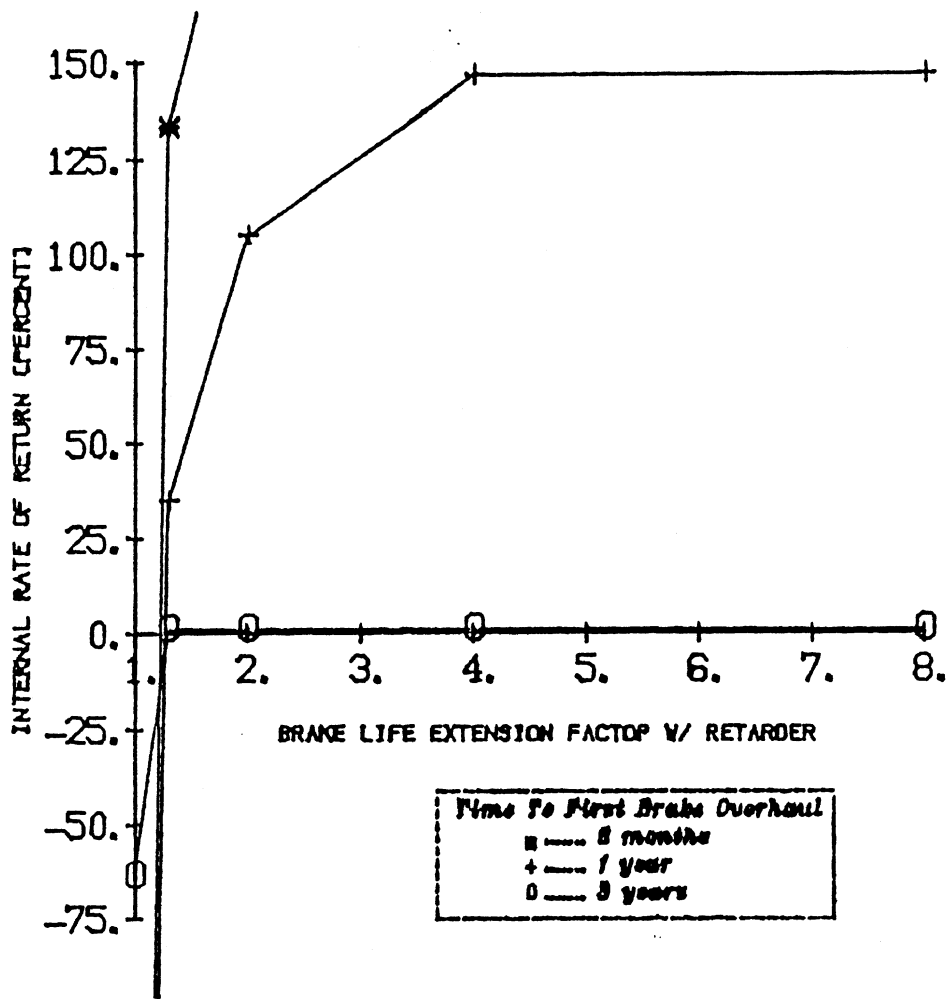
ILLUSTRATIONS OF
EFFECT OF BRAKE LIFE
EXTENSION FACTOR UPON
INTERNAL RATES OF RETURN



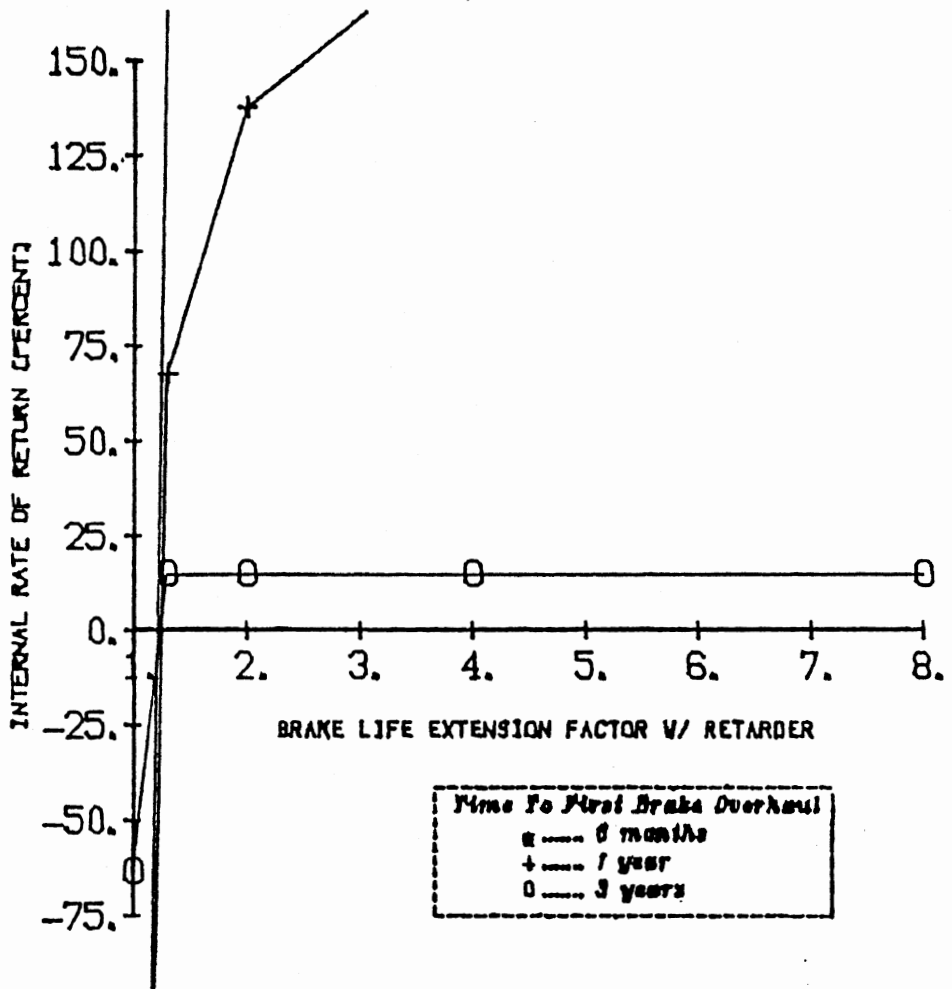
Installed Retarder Cost, dollars 450
 Expected Vehicle Life, years 4
 Total Truck Trailer Axles, number 2



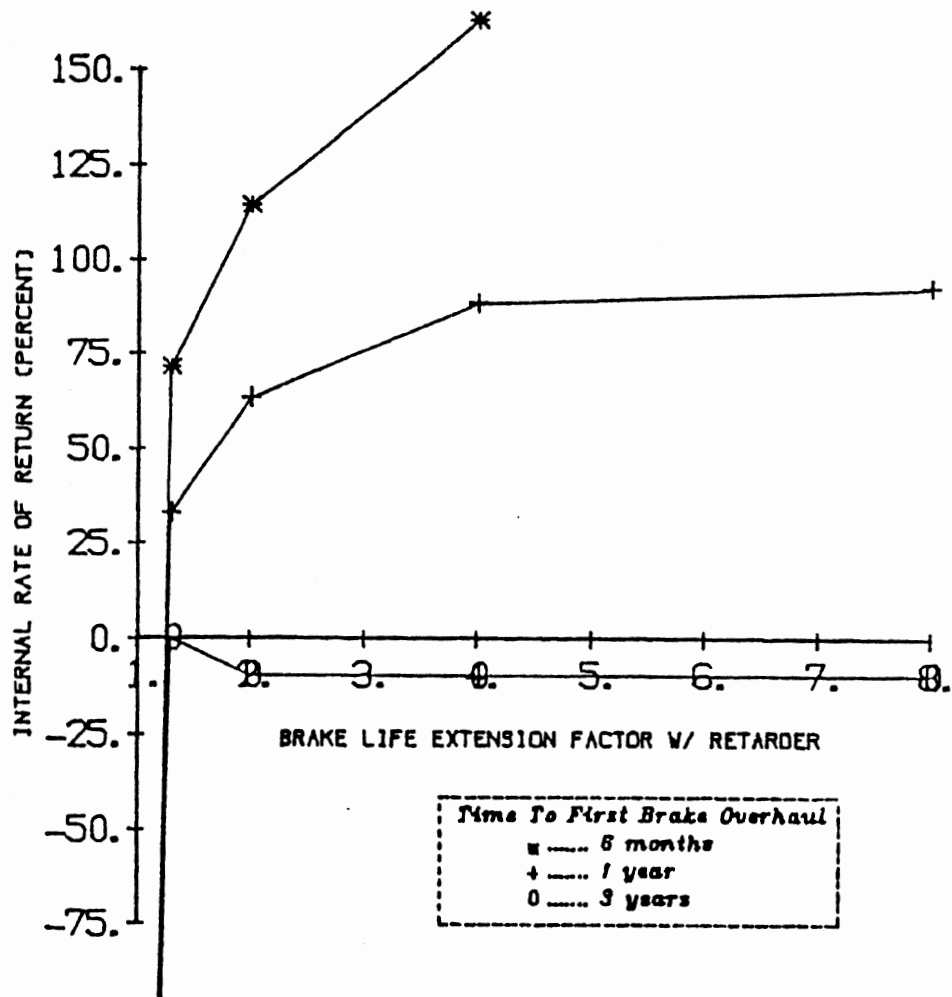
Installed Retarder Cost, dollars 450
 Expected Vehicle Life, years 4
 Total Truck Trailer Axes, number 3



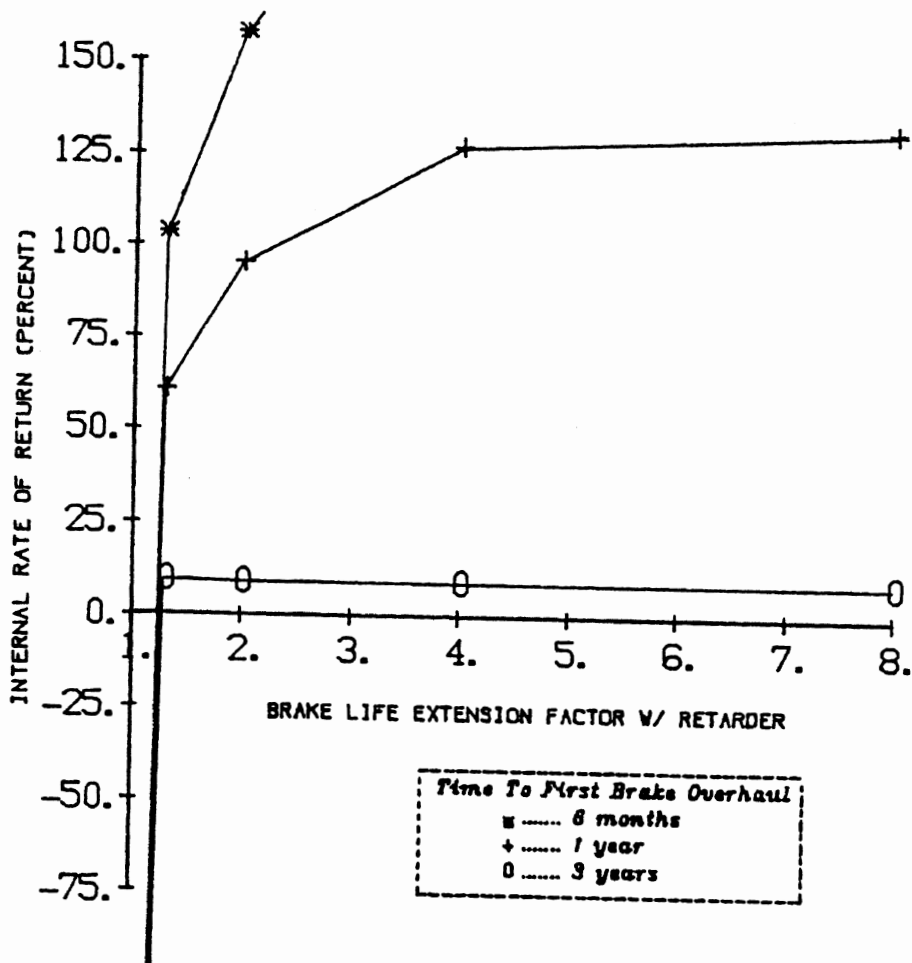
Installed Retarder Cost, dollars 450
 Expected Vehicle Life, years 4
 Total Truck Trailer Axles, number 4



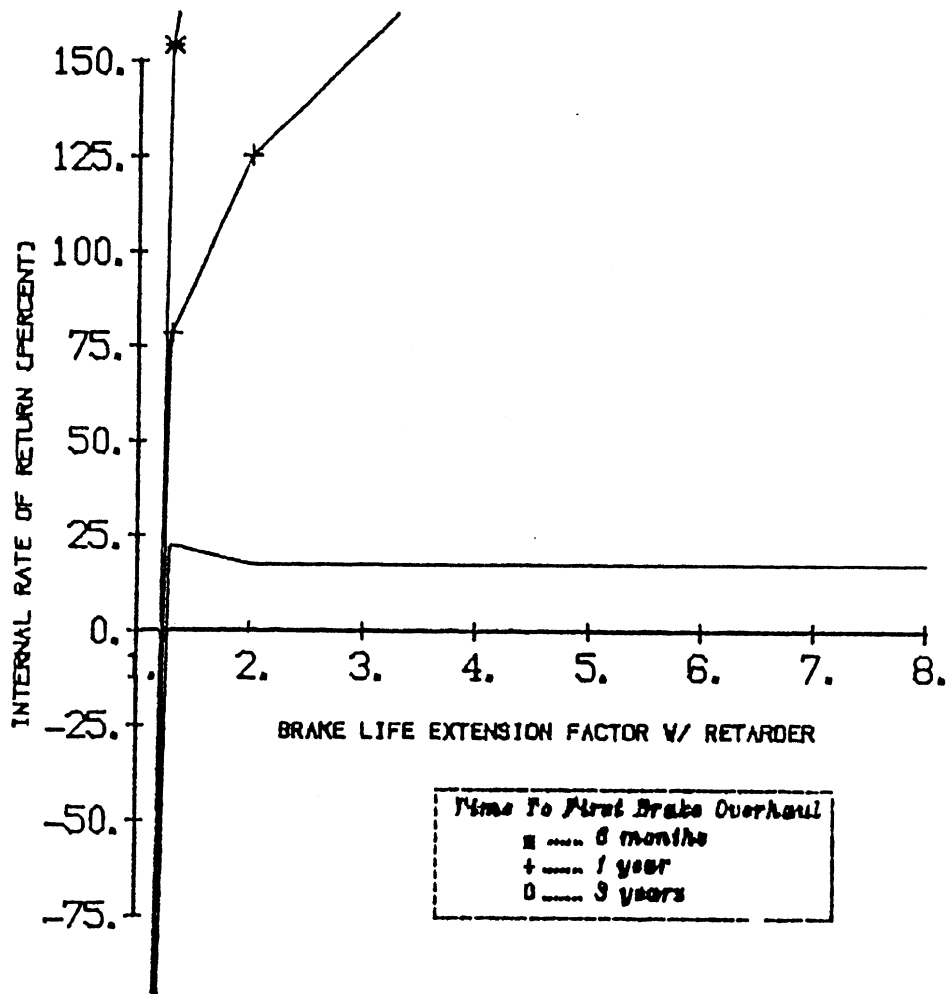
Installed Retarder Cost, dollars 450
 Expected Vehicle Life, years 4
 Total Truck Trailer Axes, number 5



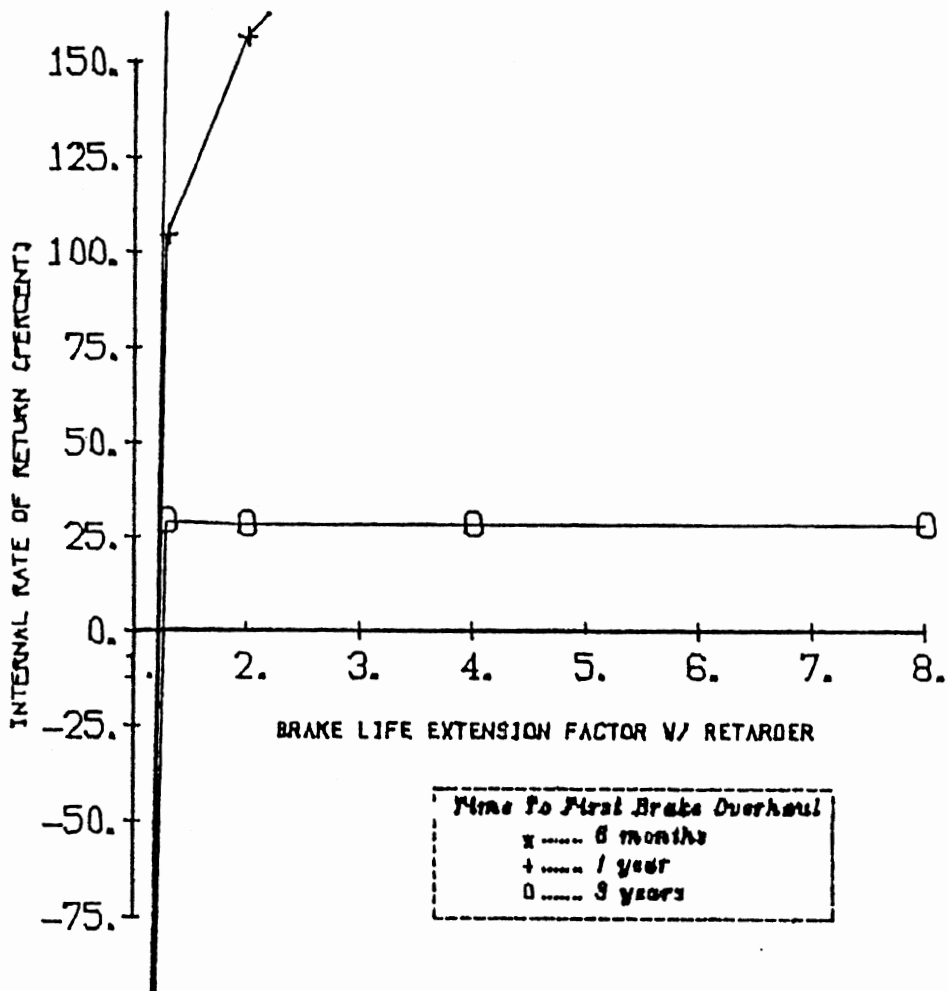
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 Expected Vehicle Life, years 6
 Total Truck Trailer Axles, number 2



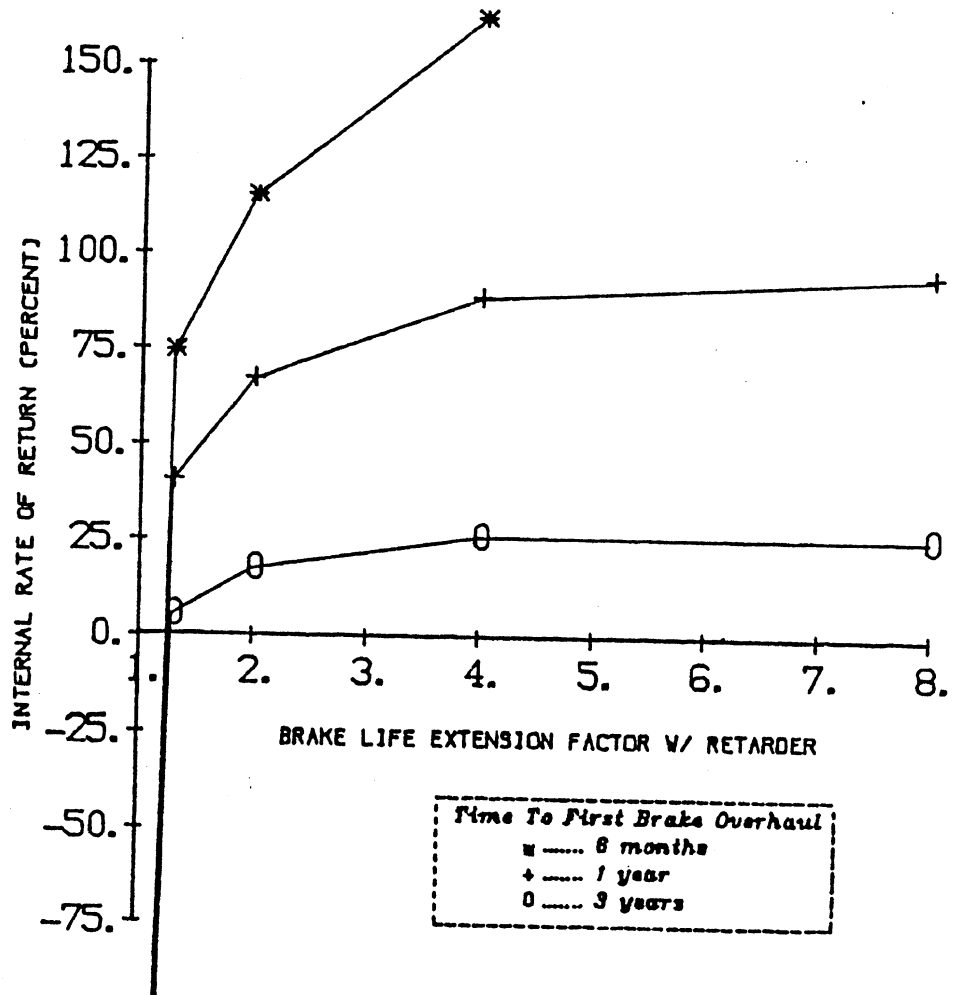
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 Expected Vehicle Life, years 6
 Total Truck Trailer Axles, number 3



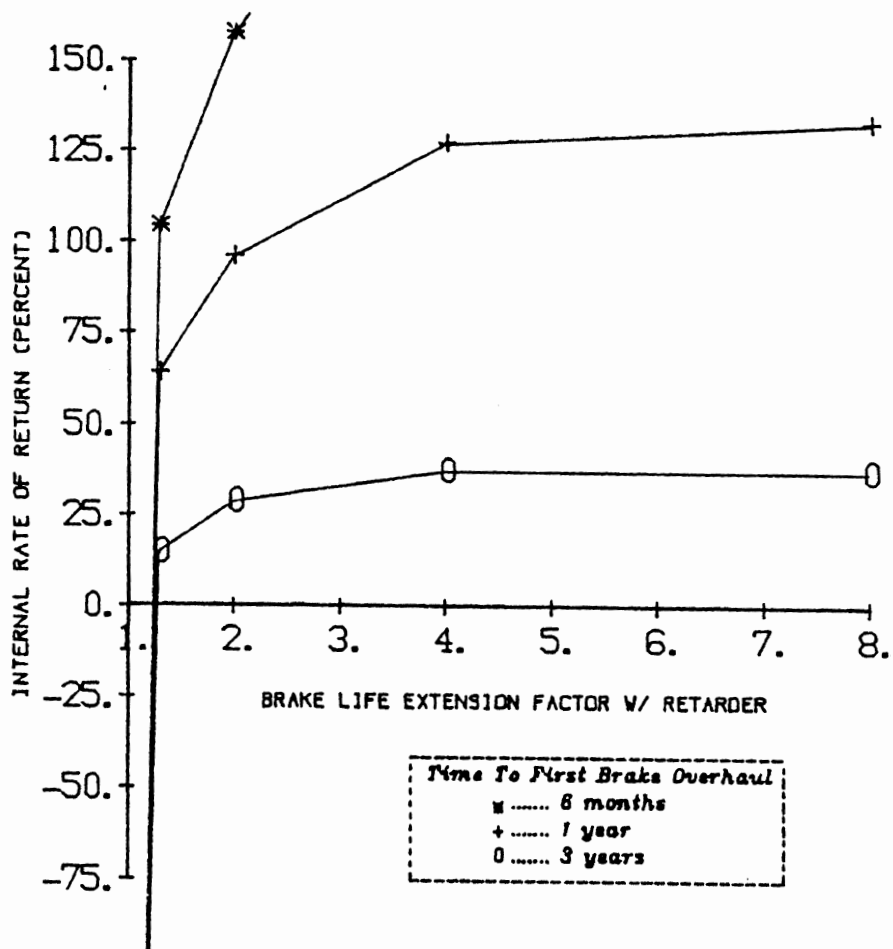
Installed Retarder Cost, dollars 450
Expected Vehicle Life, years 6
Total Truck Trailer Axles, number 4



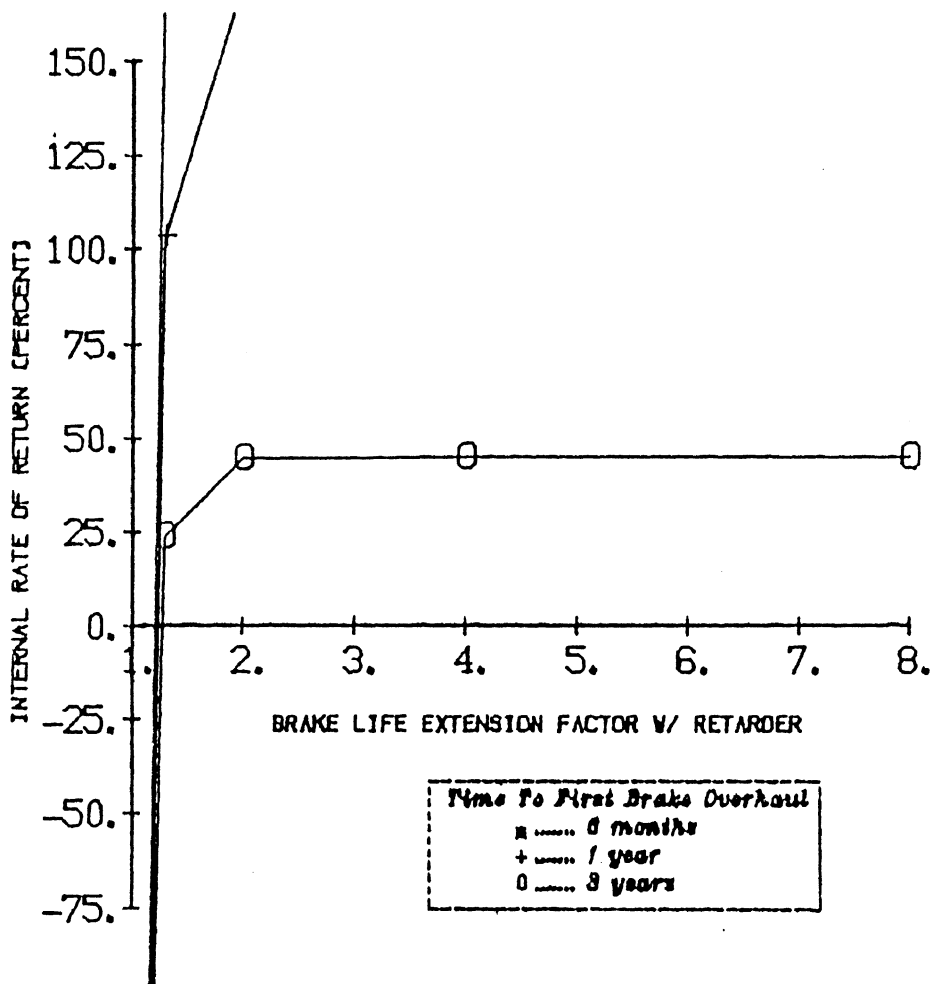
Installed Retarder Cost, dollars 450
 Expected Vehicle Life, years 6
 Total Truck Trailer Axes, number 5



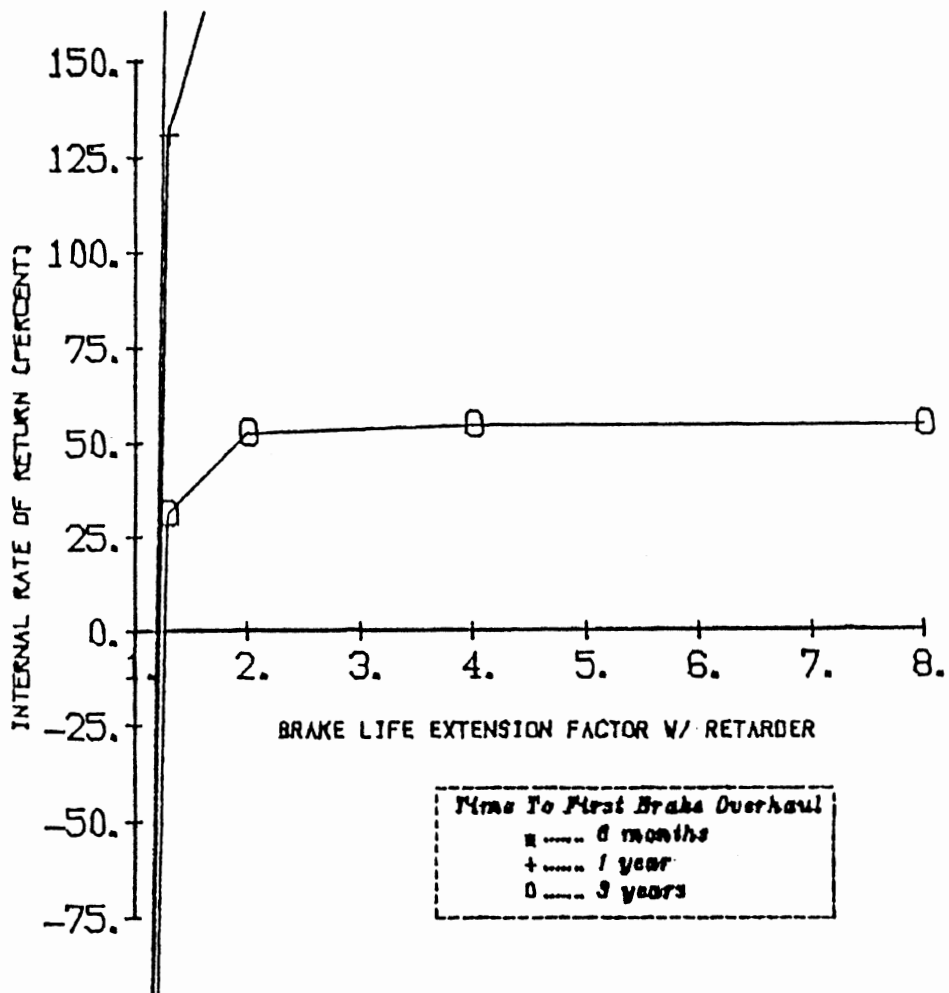
Installed Retarder Cost, dollars 450
 Expected Vehicle Life, years 10
 Total Truck Trailer Axes, number 2



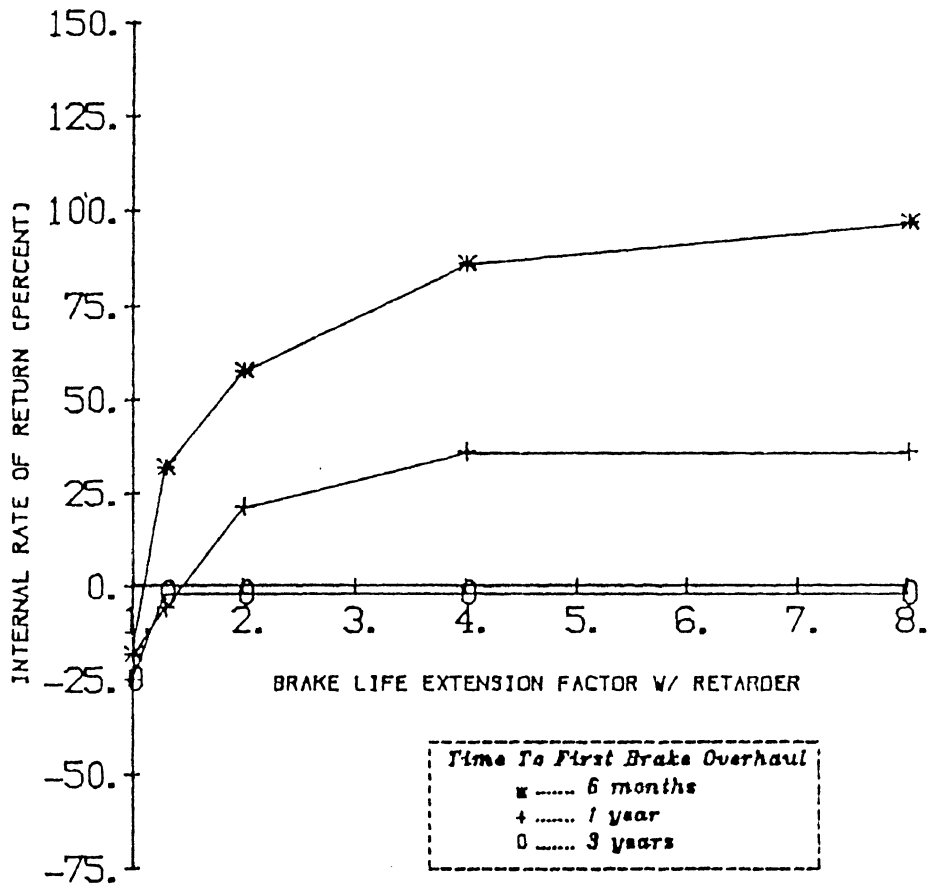
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 Expected Vehicle Life, years 10
 Total Truck Trailer Axes, number 3



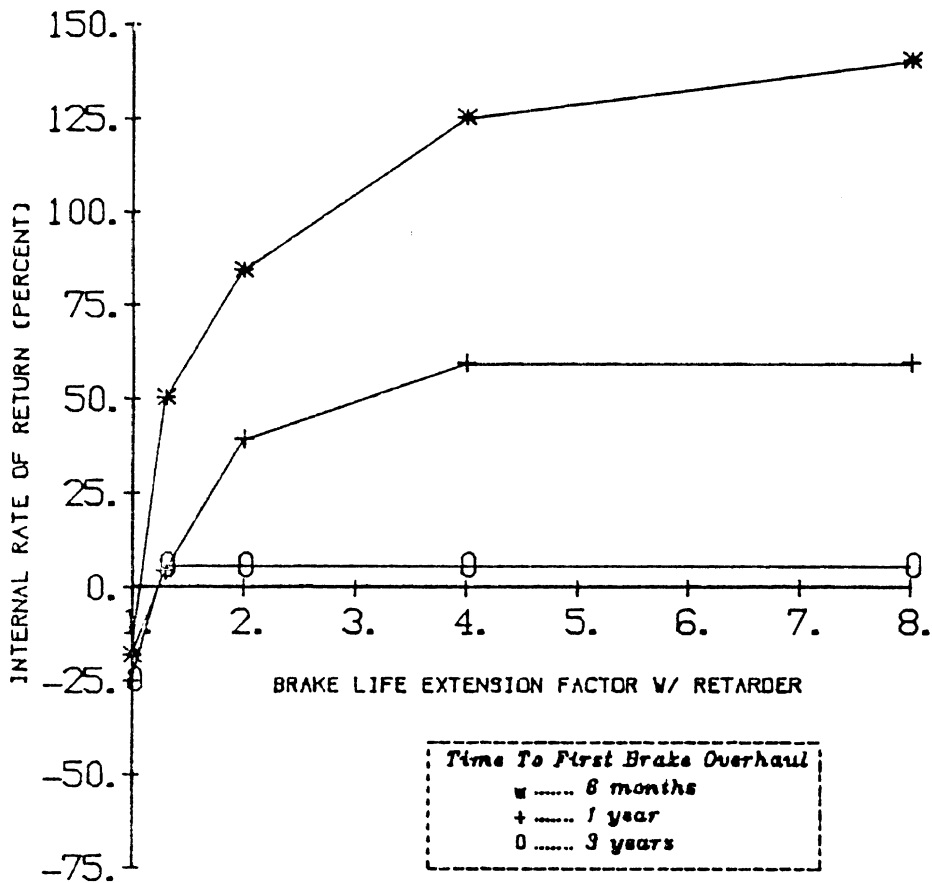
Installed Retarder Cost, dollars 450
Expected Vehicle Life, years 10
Total Truck Trailer Axles, number 4



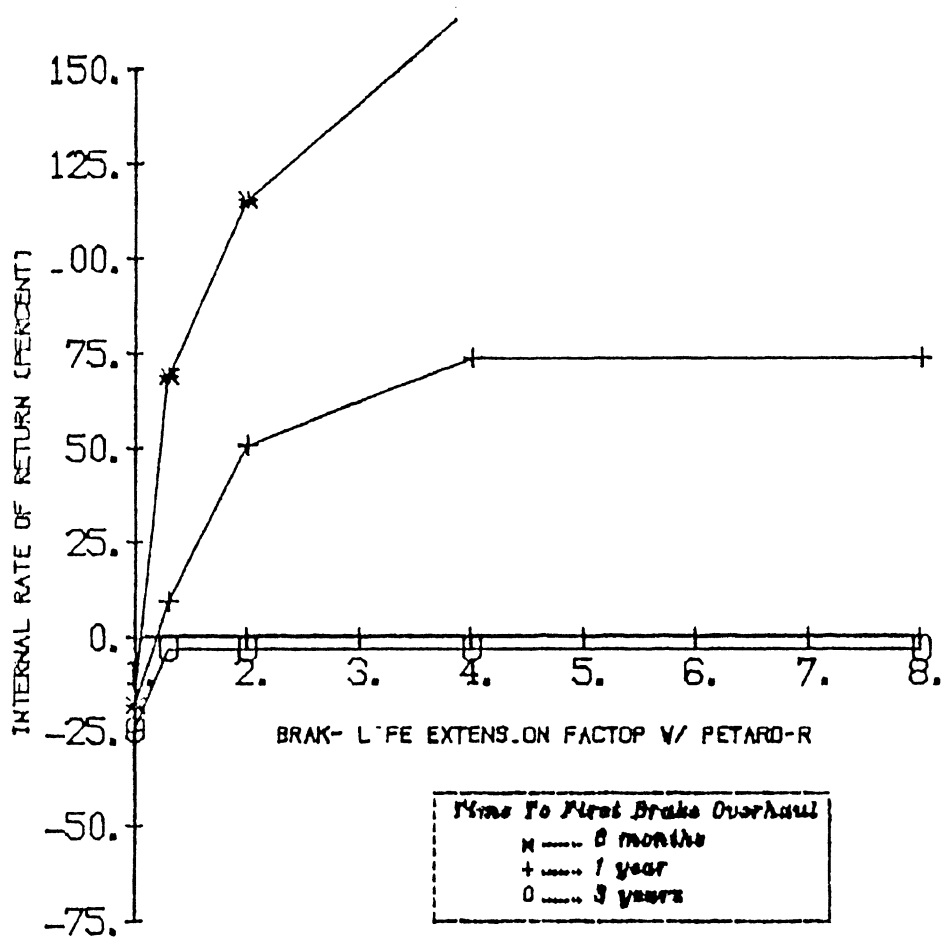
Installed Retarder Cost, dollars 450
 Expected Vehicle Life, years 10
 Total Truck Trailer Axes, number 5



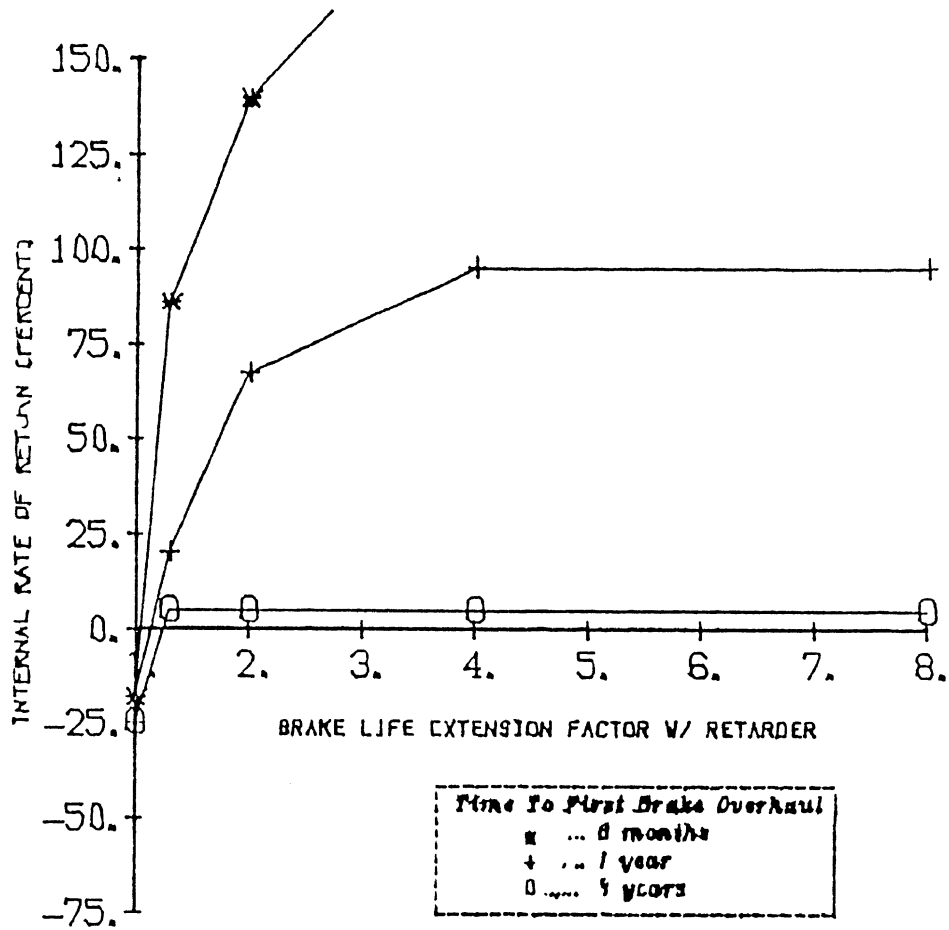
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 Expected Vehicle Life, years 4
 Total Truck Trailer Axles, number 2



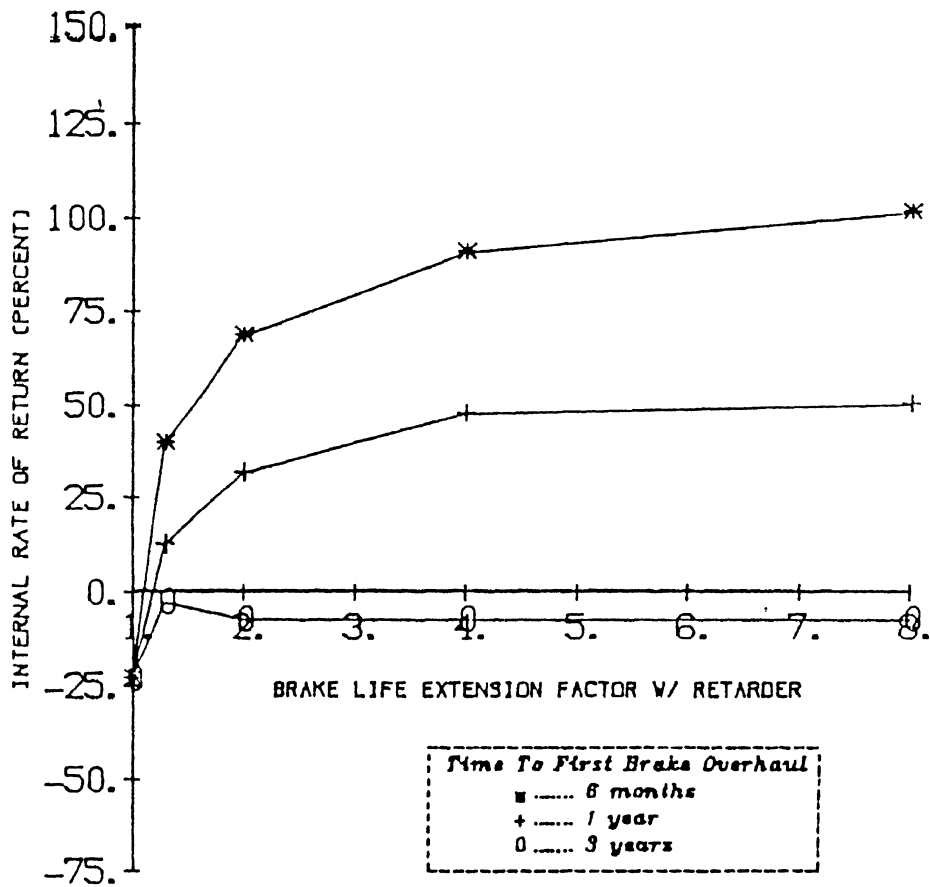
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 Expected Vehicle Life, years 4
 Total Truck Trailer Axes, number 3



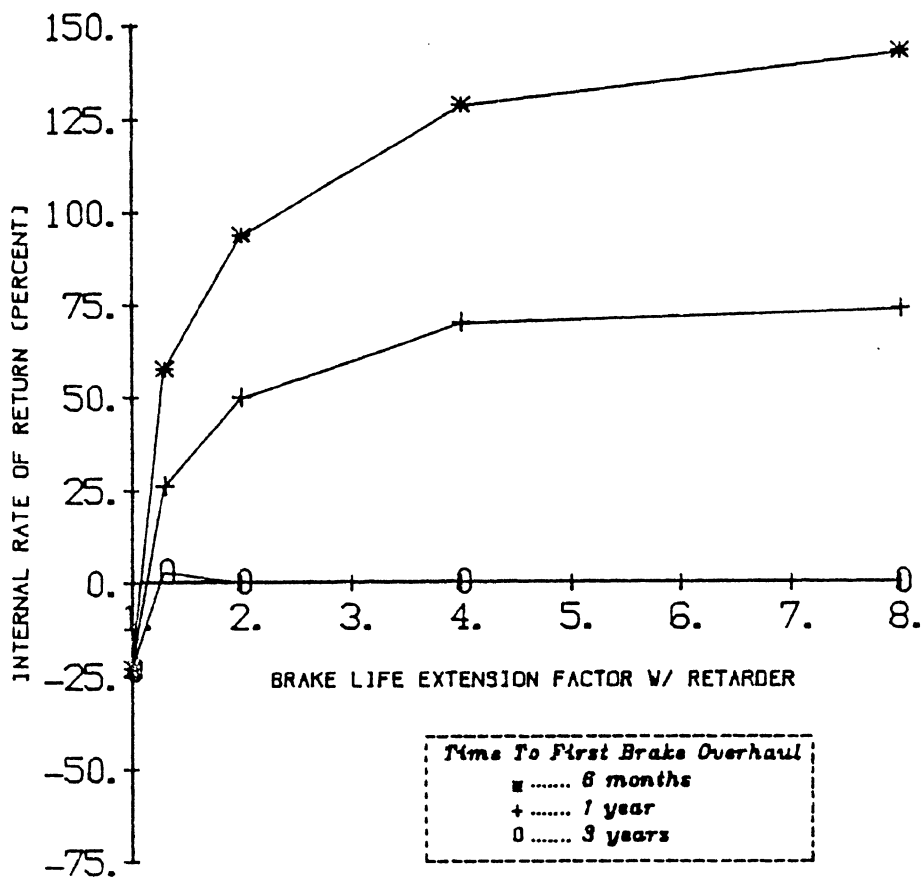
Installed Retarder Cost, dollars 900
 Expected Vehicle Life, years 4
 Total Truck Trailer Axes, number 4



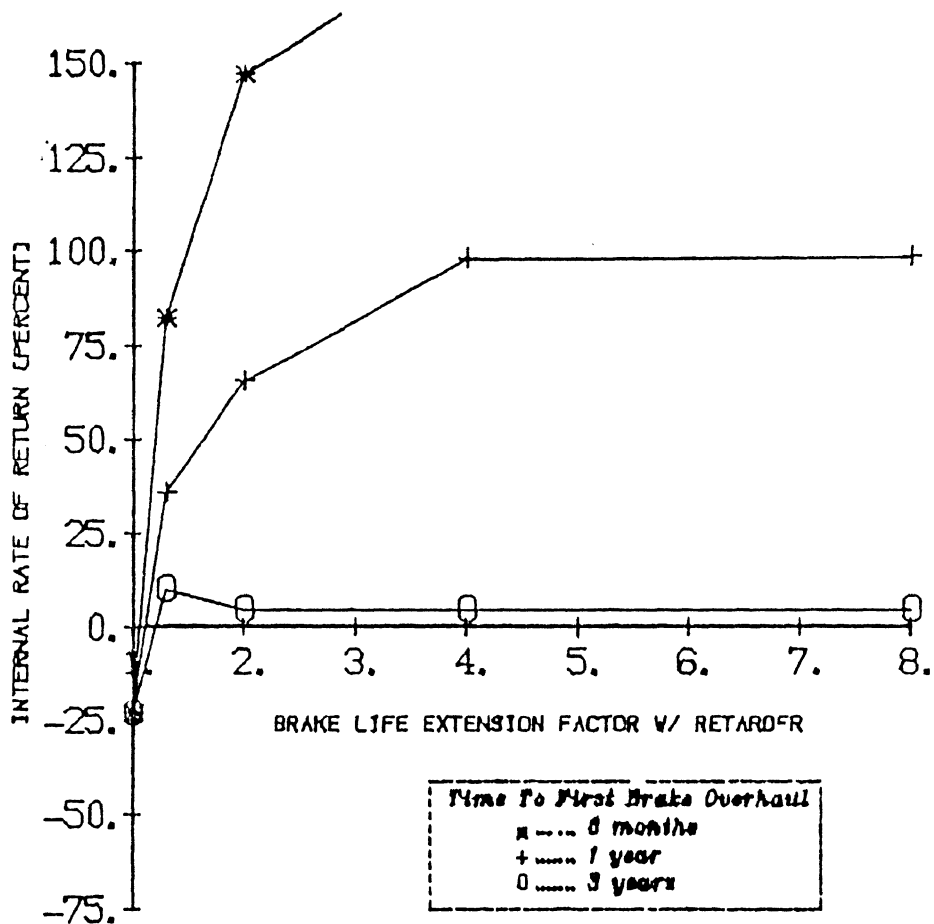
Installed Retarder Cost, dollars 900
 Expected Vehicle Life, years 4
 Total Truck Trailer Axles, number 5



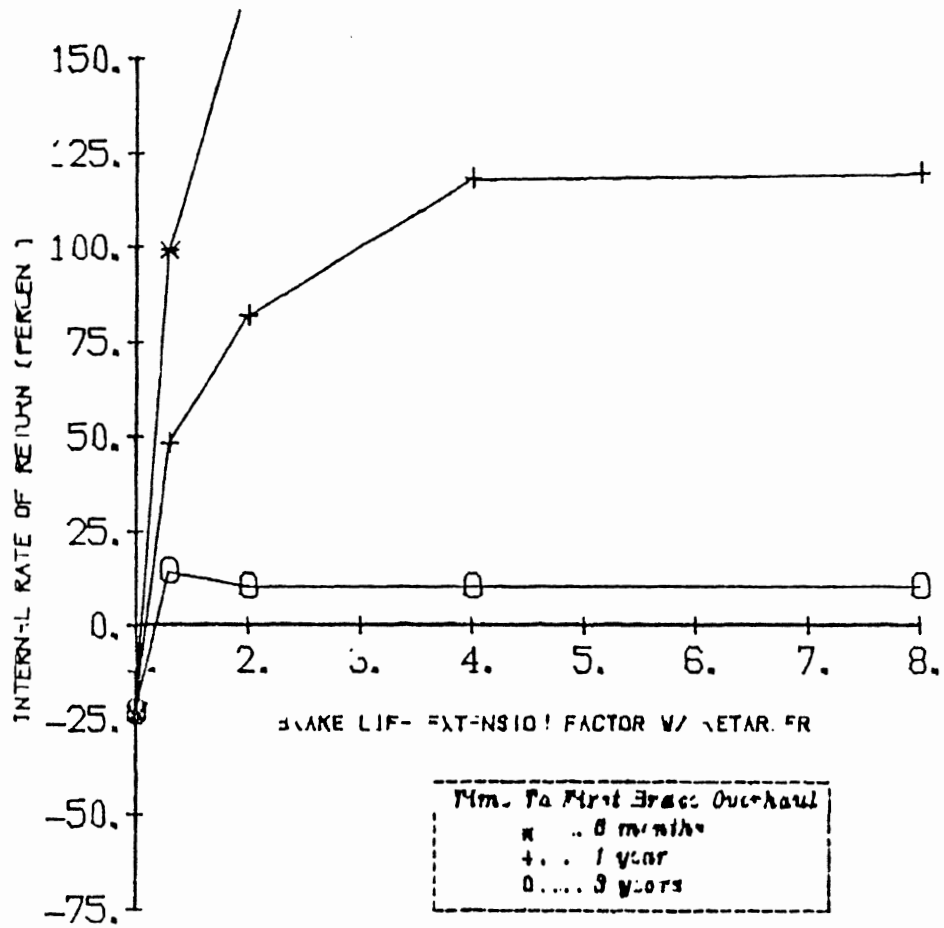
Installed Retarder Cost, dollars 900
 Expected Vehicle Life, years 6
 Total Truck Trailer Axles, number 2



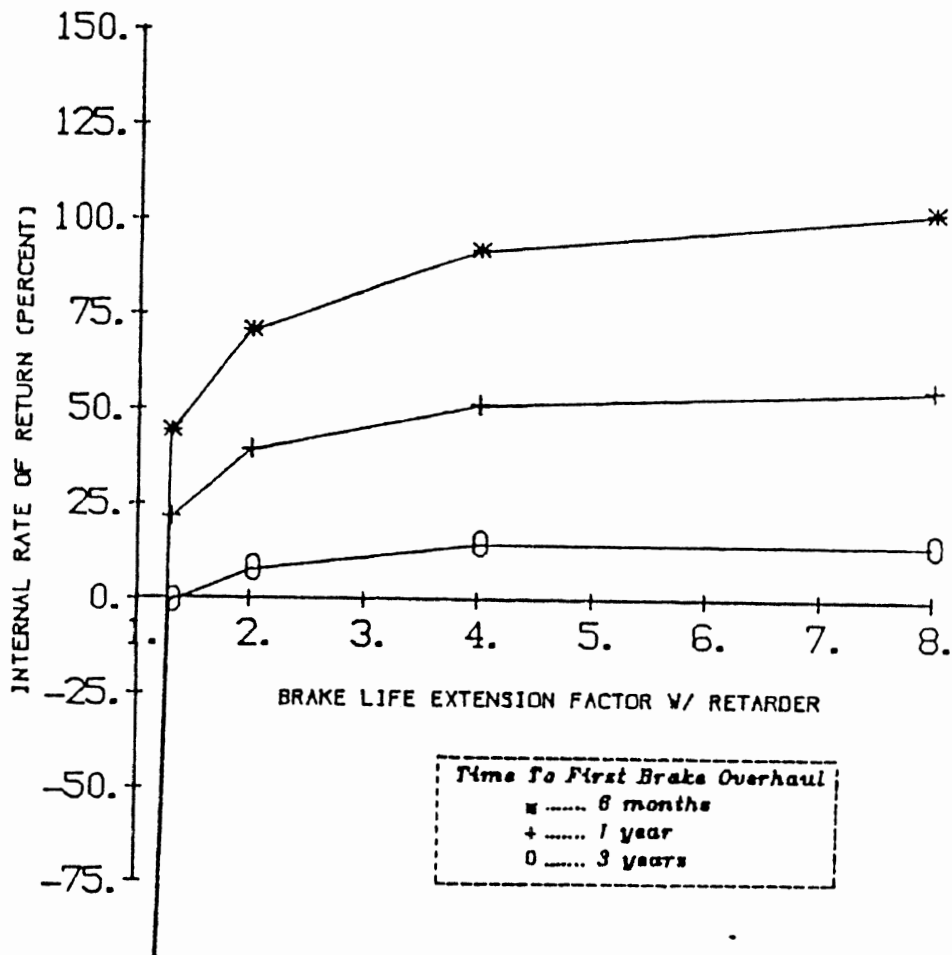
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 Expected Vehicle Life, years 6
 Total Truck Trailer Axes, number 3



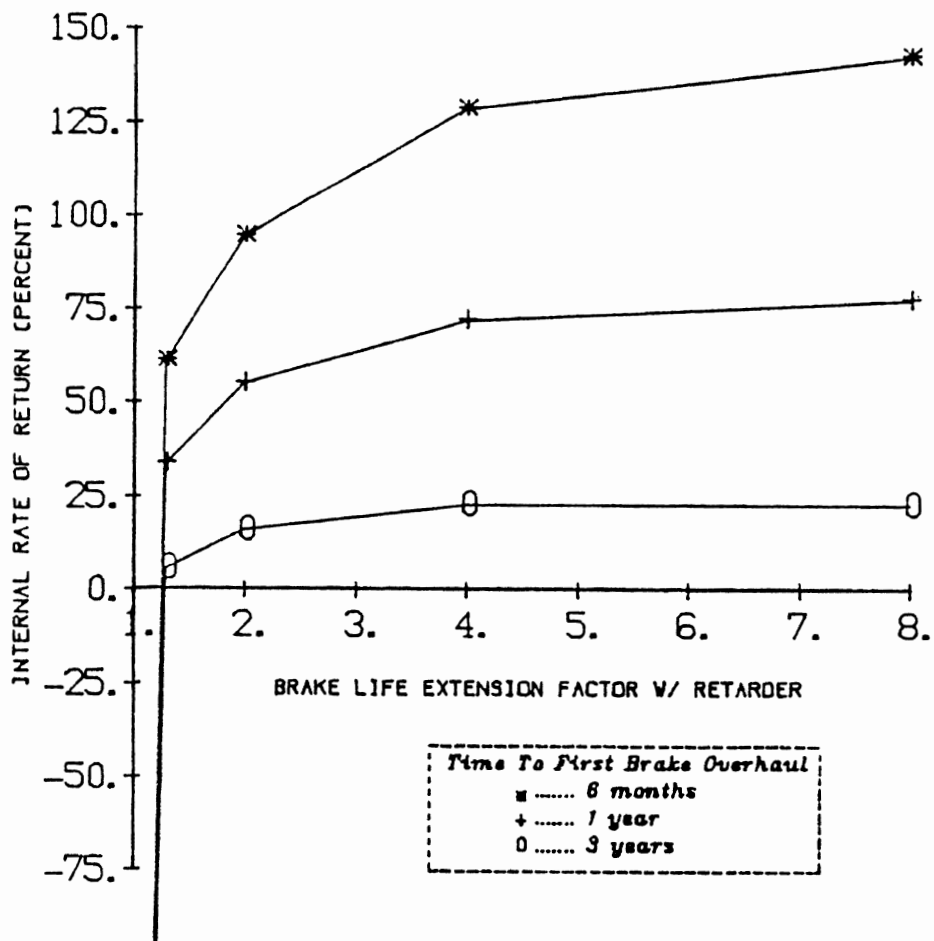
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Expected Vehicle Life, years 6
Total Truck Trailer Axles, number 4



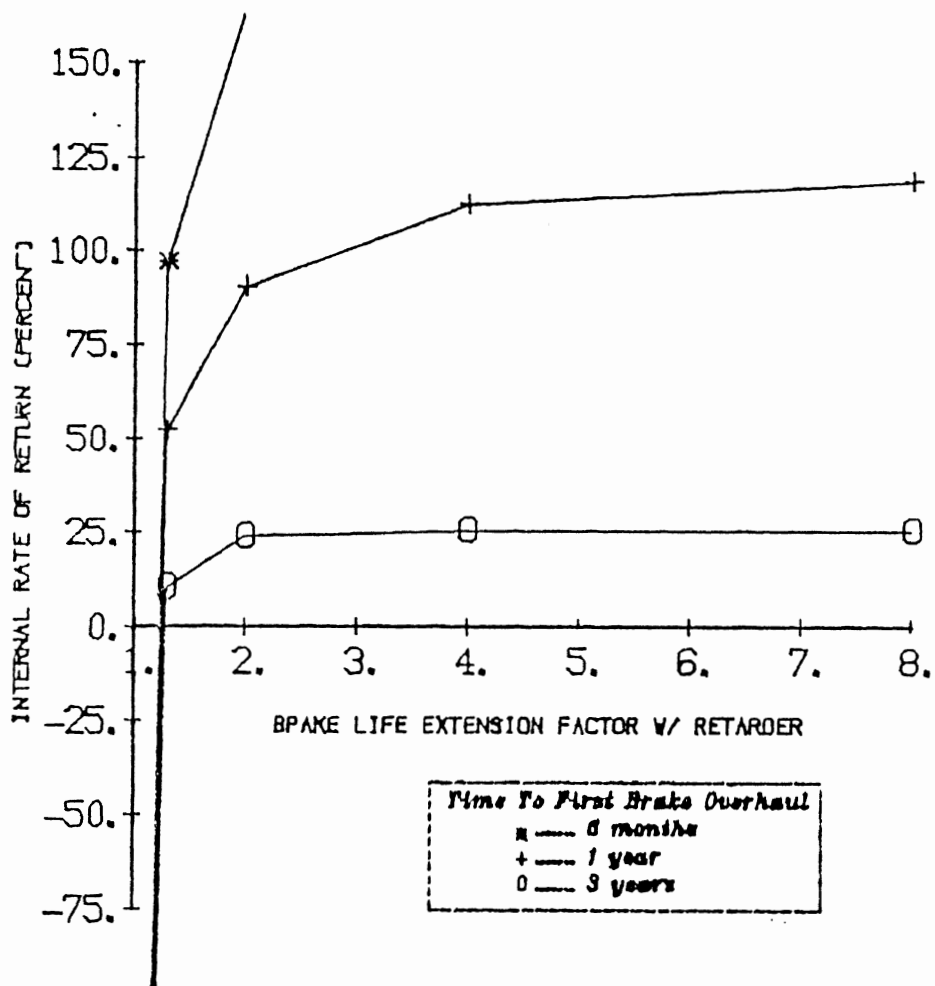
Installed Retarder Cost. dollars 900
 Expected Vehicle Life years 6
 Total Truck Trailer Axles, number 5



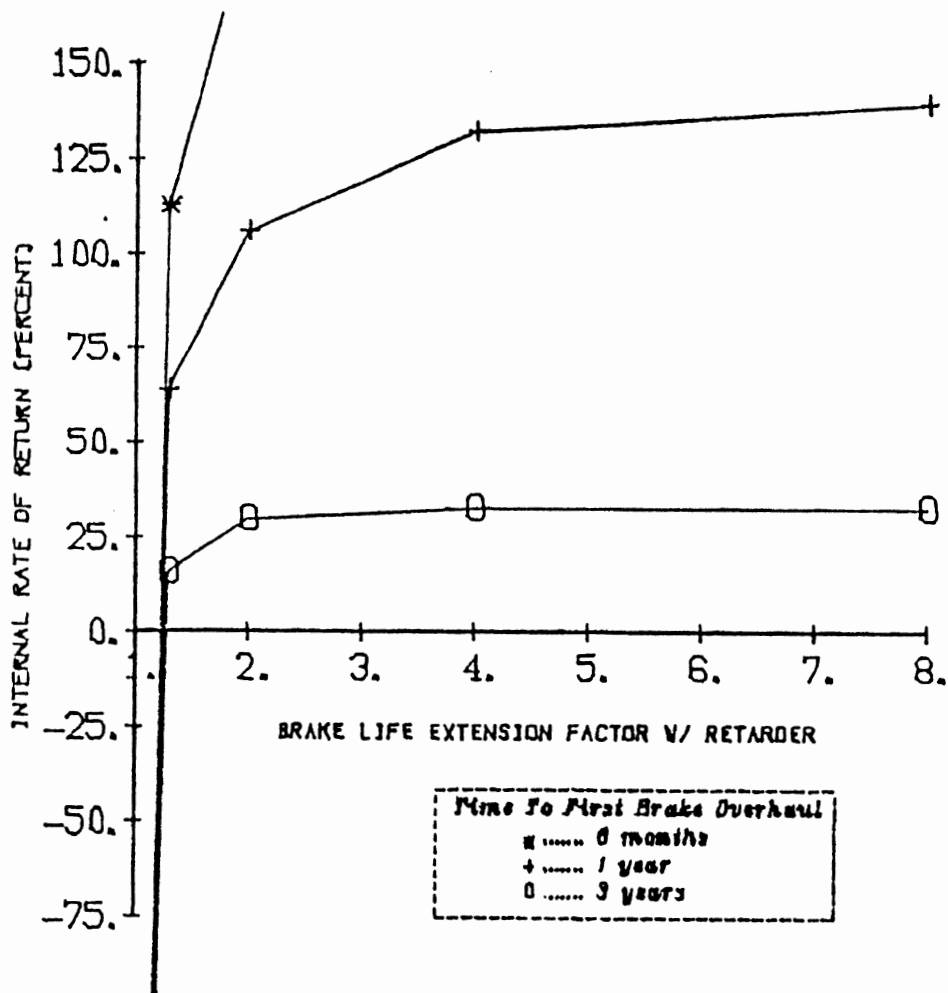
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 Expected Vehicle Life, years 10
 Total Truck Trailer Axles, number 2



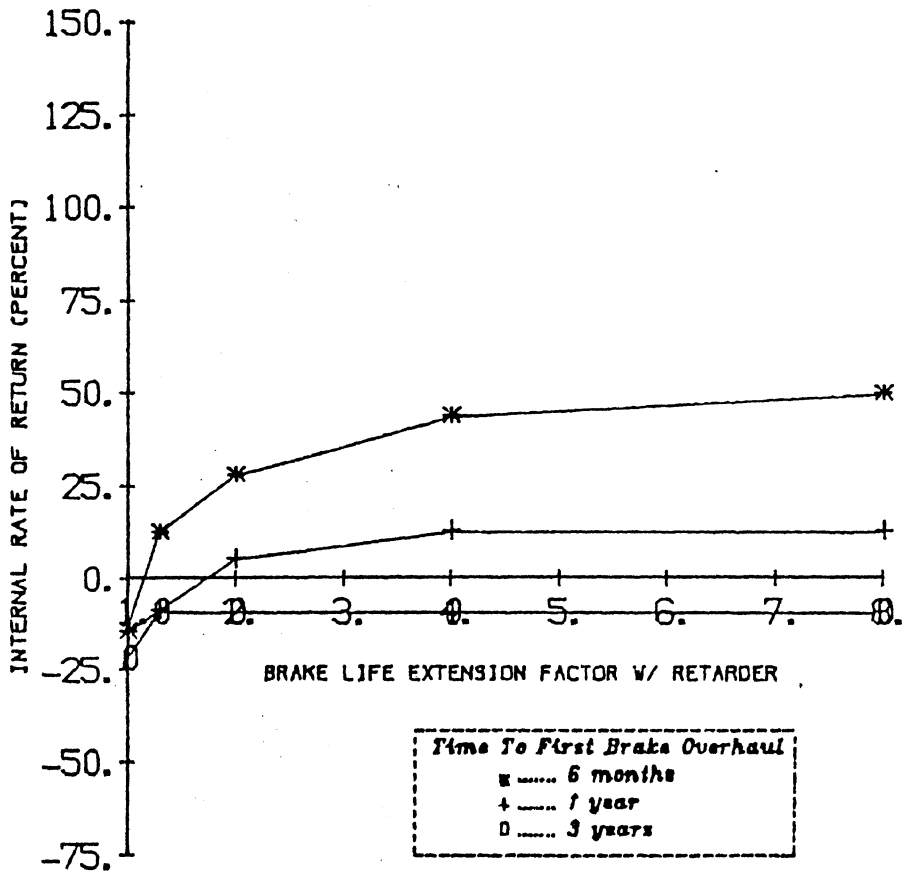
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 Expected Vehicle Life, years 10
 Total Truck Trailer Axes, number 3



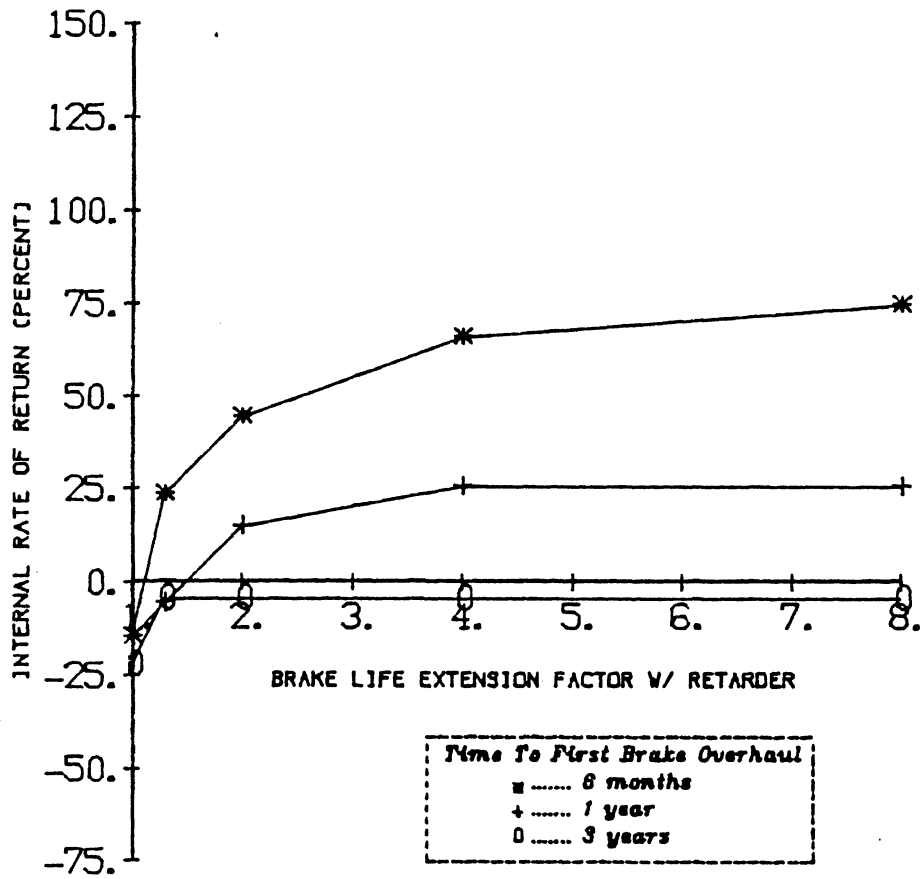
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 Expected Vehicle Life, years 10
 Total Truck Trailer Axles, number 4



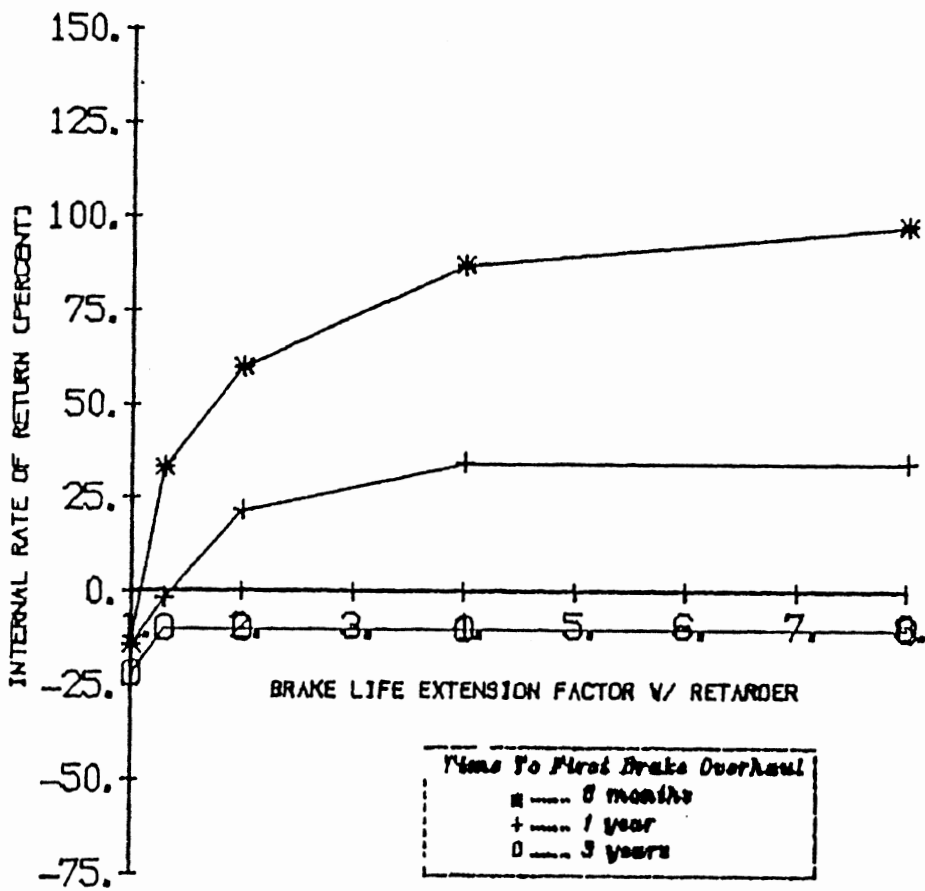
Installed Retarder Cost, dollars 900
 Expected Vehicle Life, years 10
 Total Truck Trailer Axles, number 5



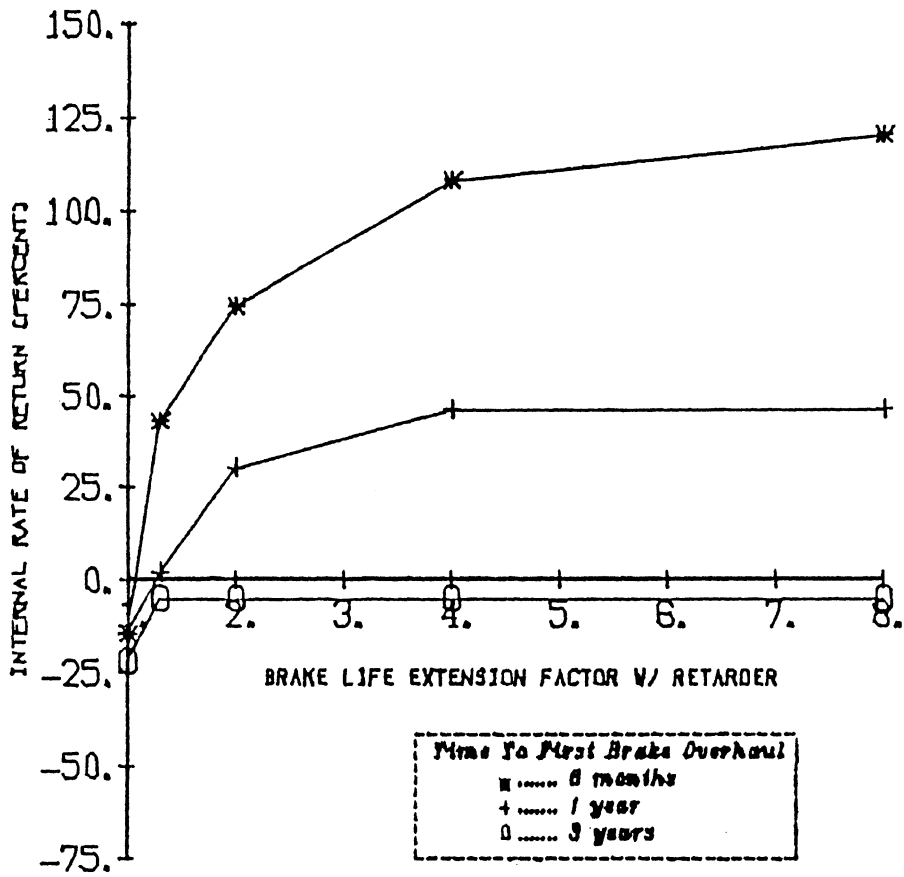
Installed Retarder Cost, dollars 1800
 Expected Vehicle Life, years 4
 Total Truck Trailer Axes, number 2



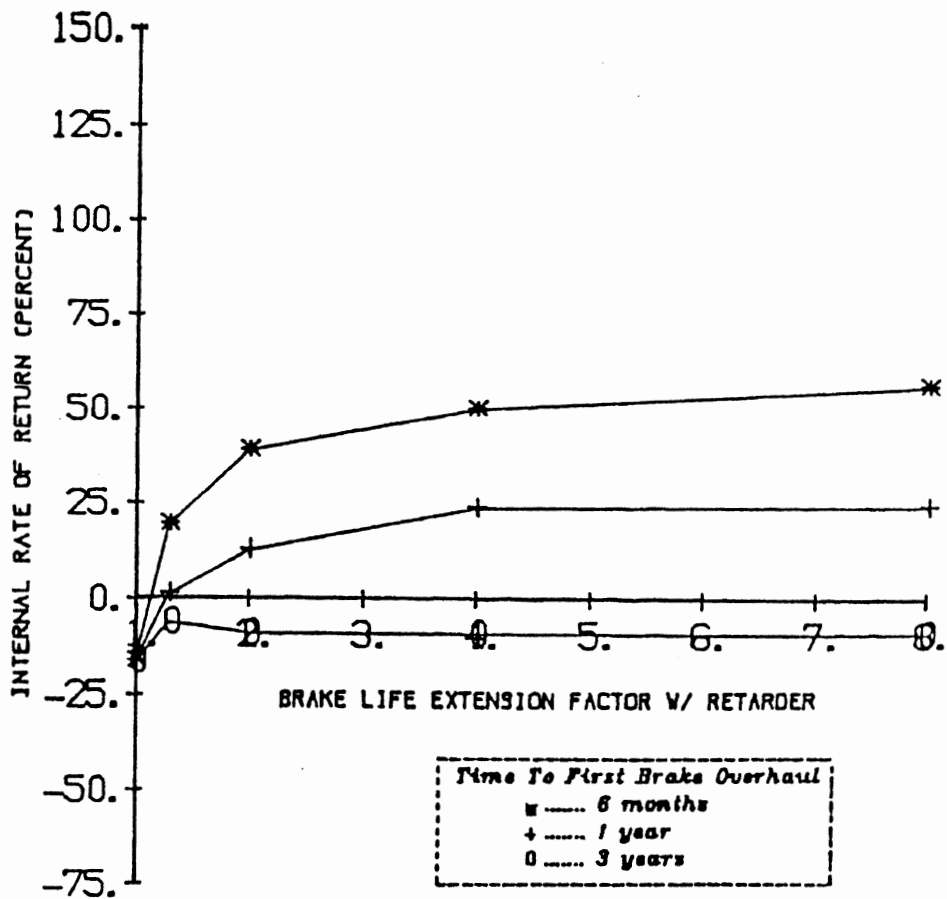
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 Expected Vehicle Life, years 4
 Total Truck Trailer Axles, number 3



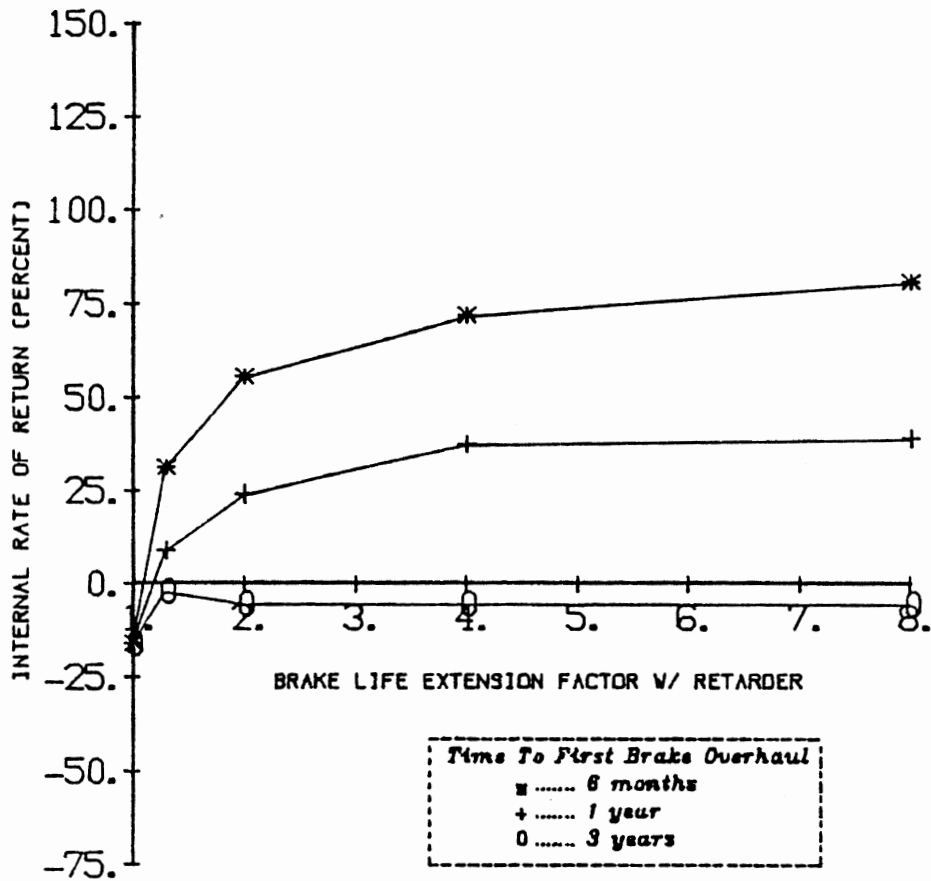
Installed Retarder Cost, dollars 1800
 Expected Vehicle Life, years 4
 Total Truck Trailer Axles, number 4



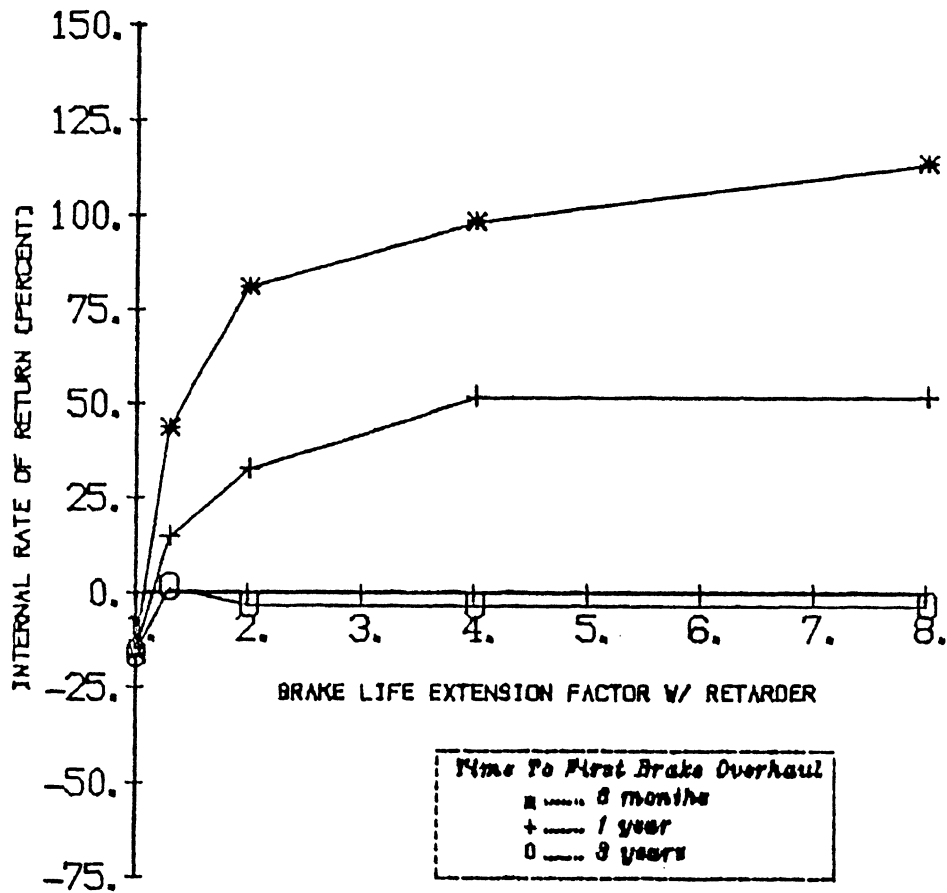
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 Expected Vehicle Life, years 4
 Total Truck Trailer Axes, number 5



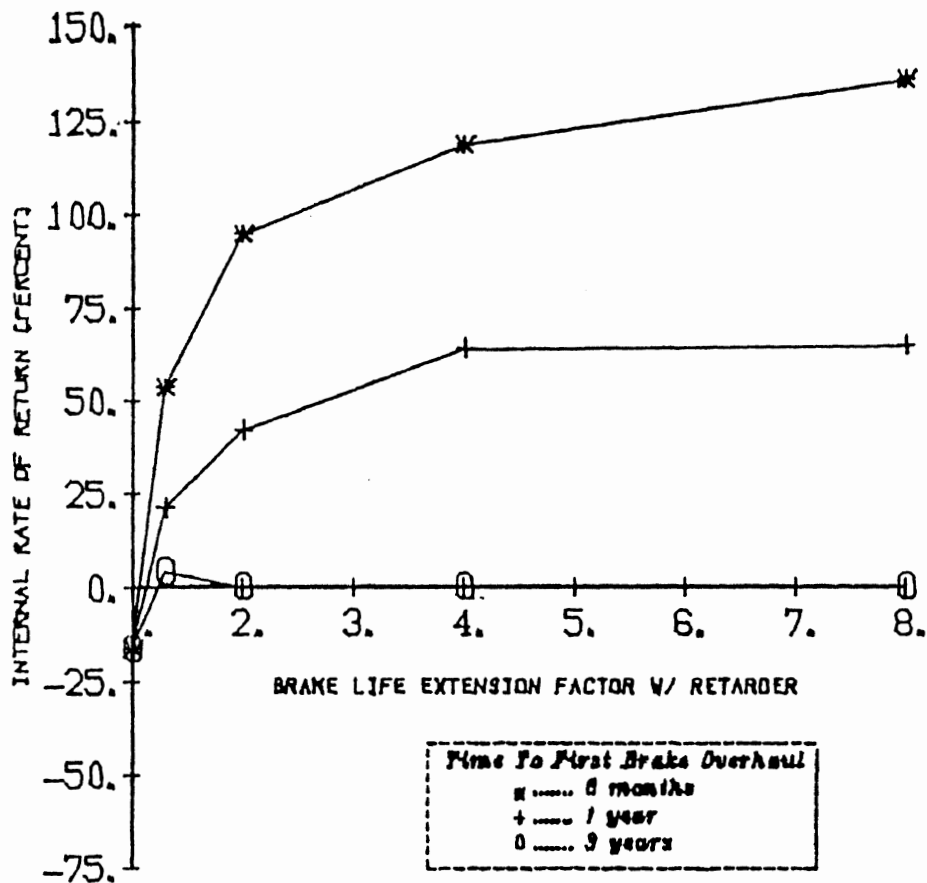
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 Expected Vehicle Life, years 6
 Total Truck Trailer Axes, number 2



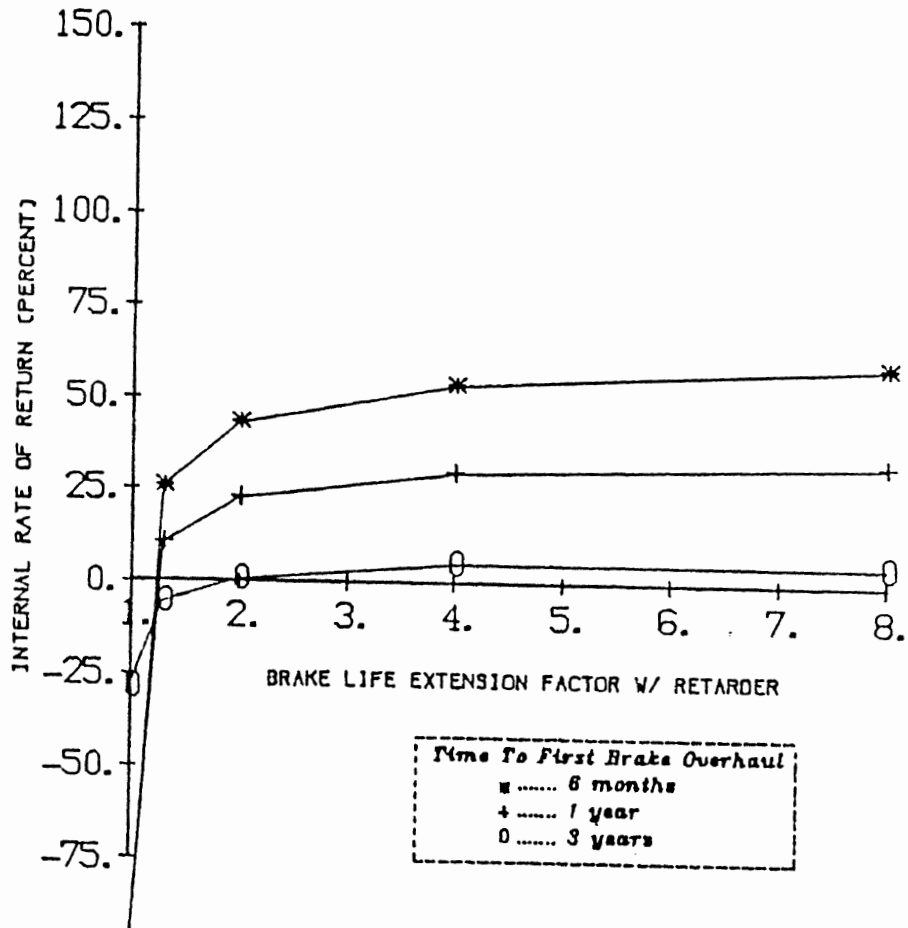
Installed Retarder Cost, dollars 1800
 Expected Vehicle Life, years 6
 Total Truck Trailer Axes, number 3



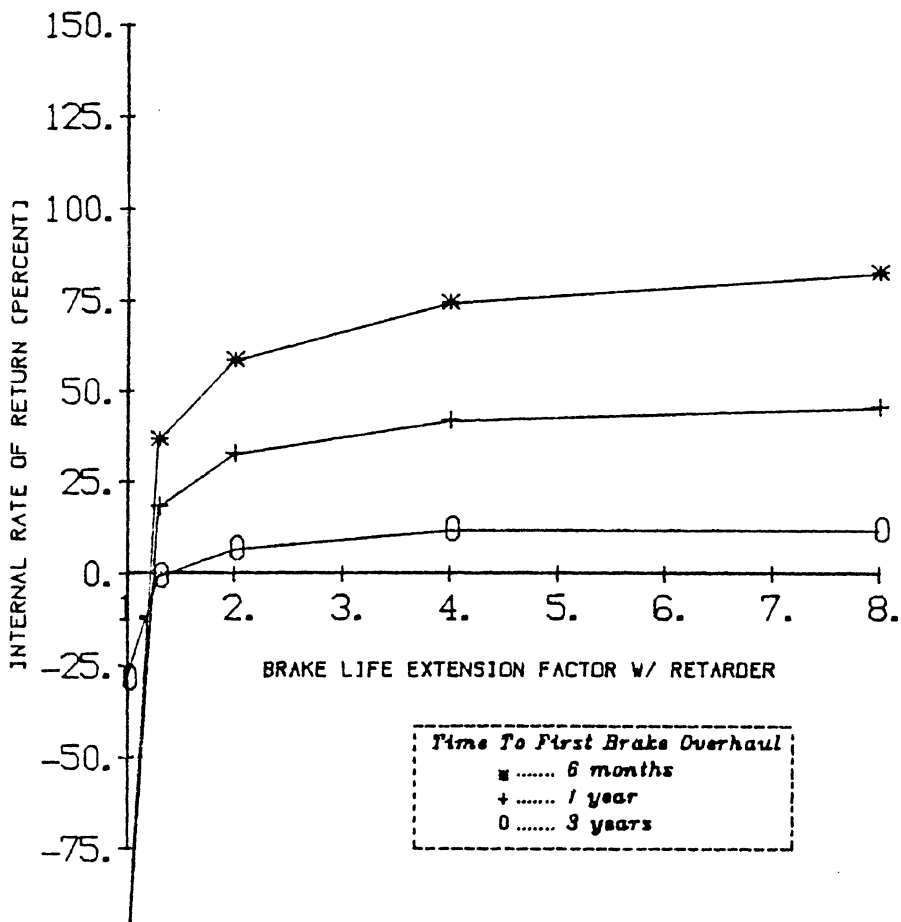
Installed Retarder Cost, dollars 1800
 Expected Vehicle Life, years 6
 Total Truck Trailer Axles, number 4



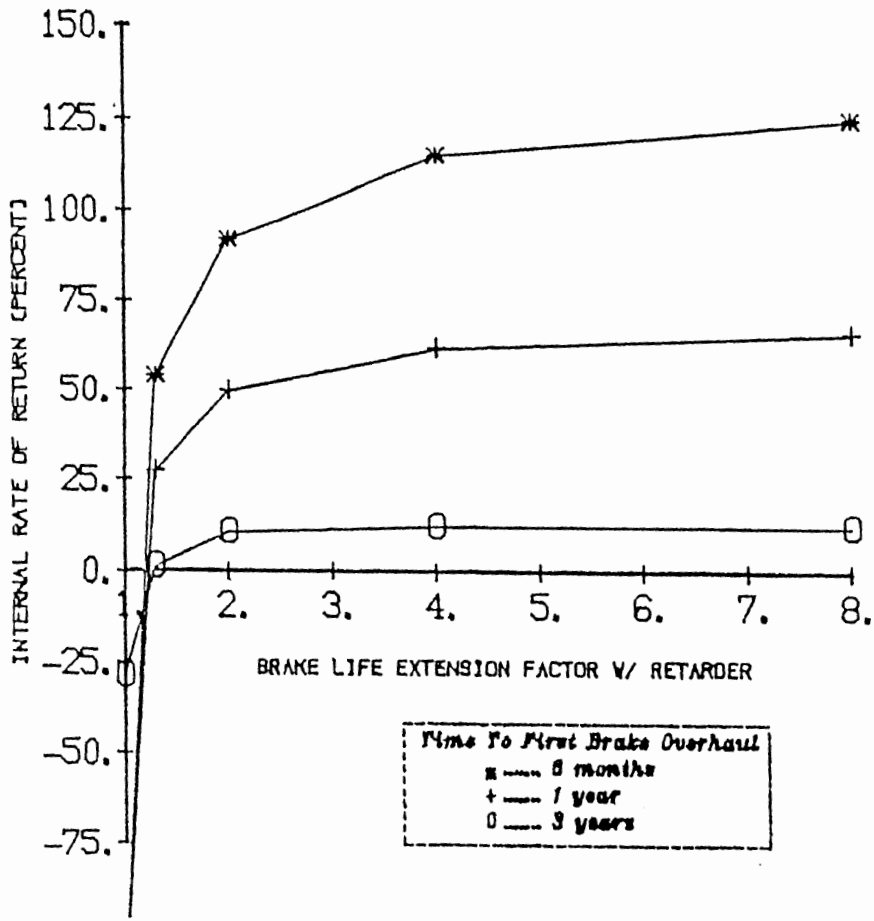
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 Expected Vehicle Life, years 6
 Total Truck Trailer Axes, number 5



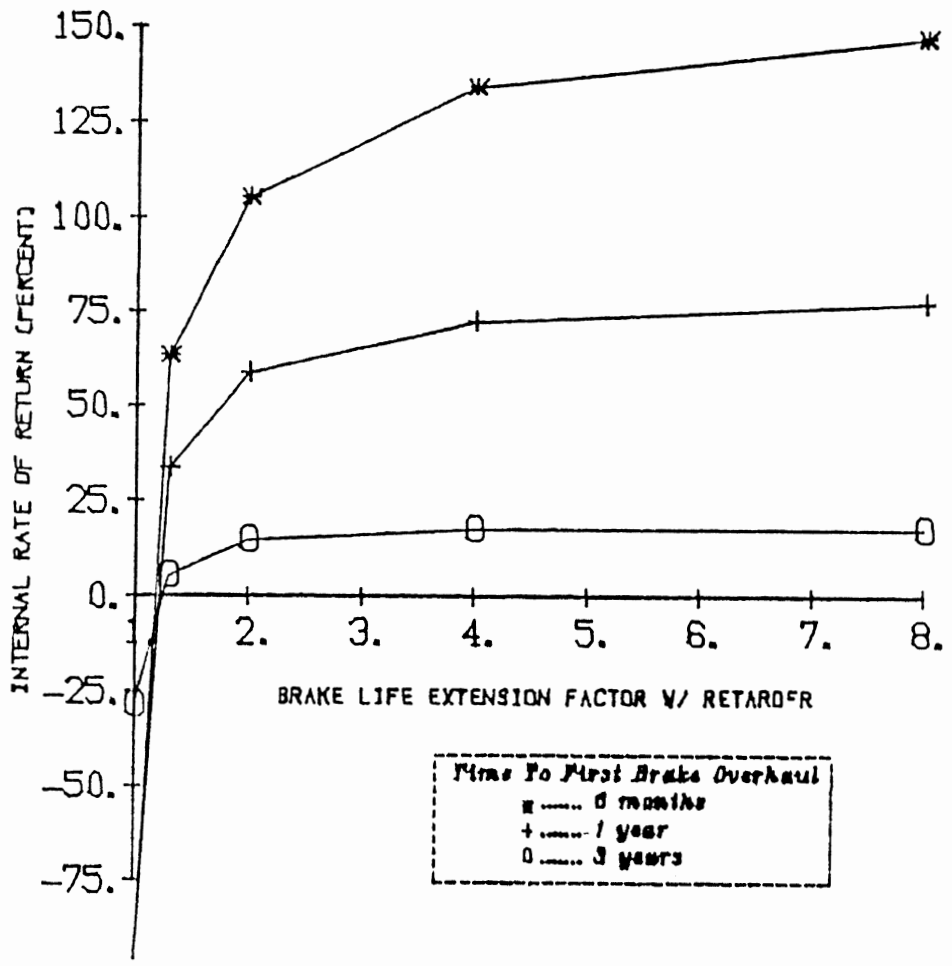
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 Expected Vehicle Life, years 10
 Total Truck Trailer Axes, number 2



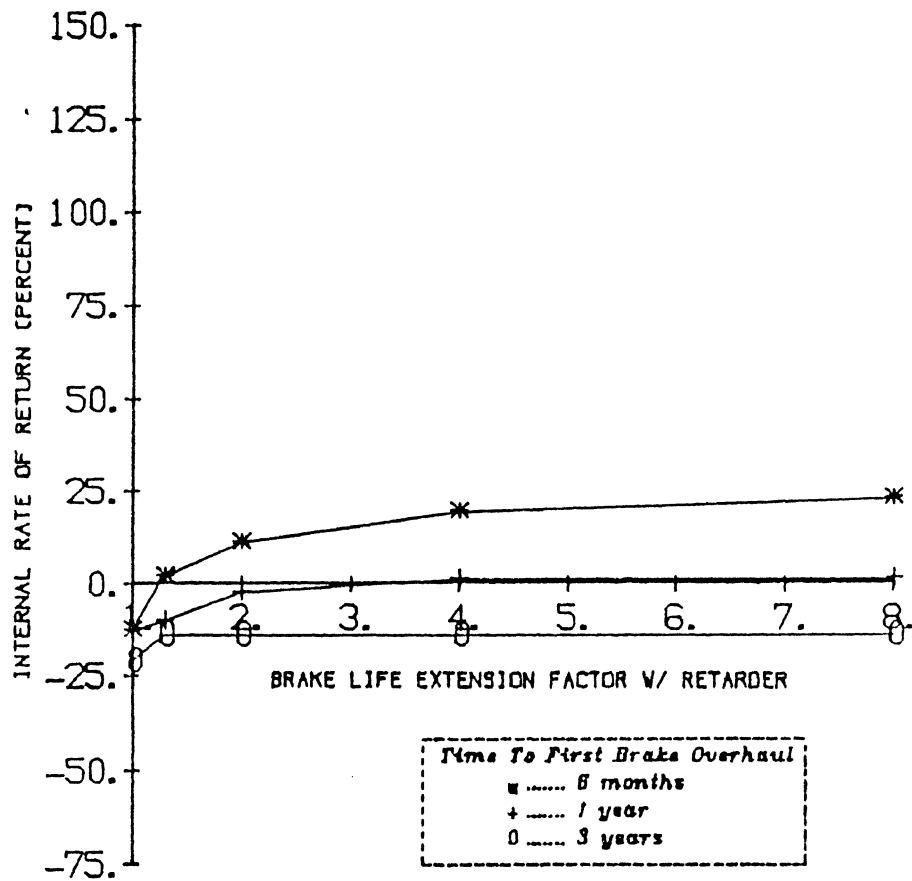
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 Expected Vehicle Life, years 10
 Total Truck Trailer Axles, number 3



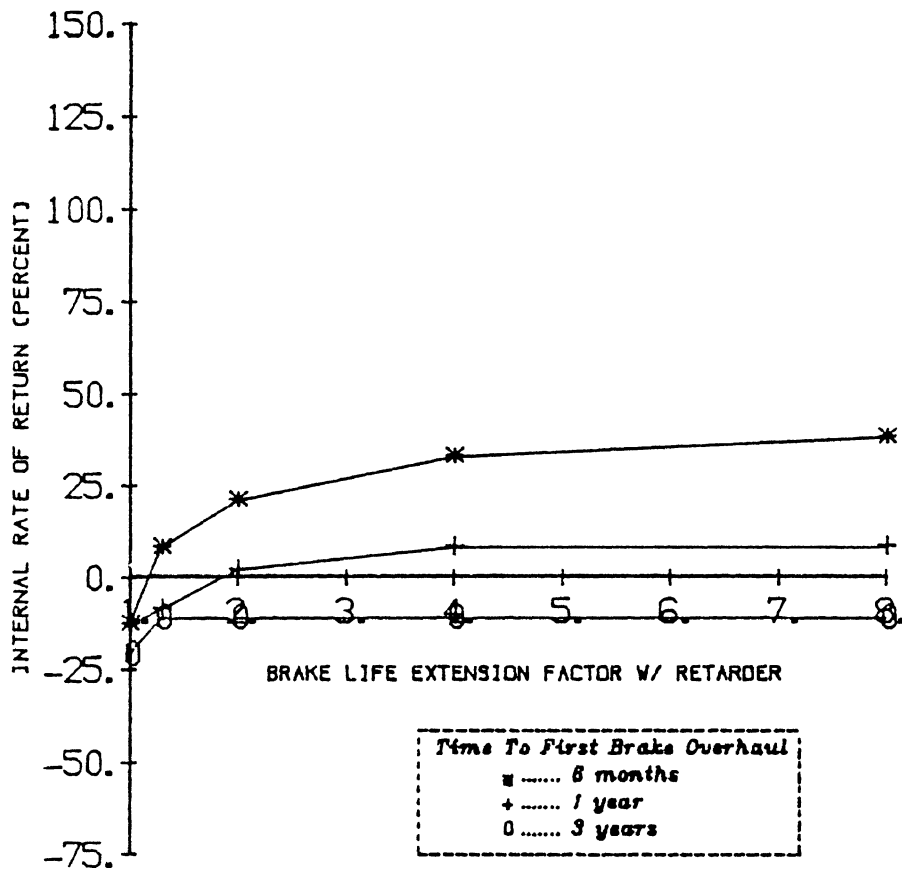
Installed Retarder Cost, dollars 1800
 Expected Vehicle Life, years 10
 Total Truck Trailer Axles, number 4



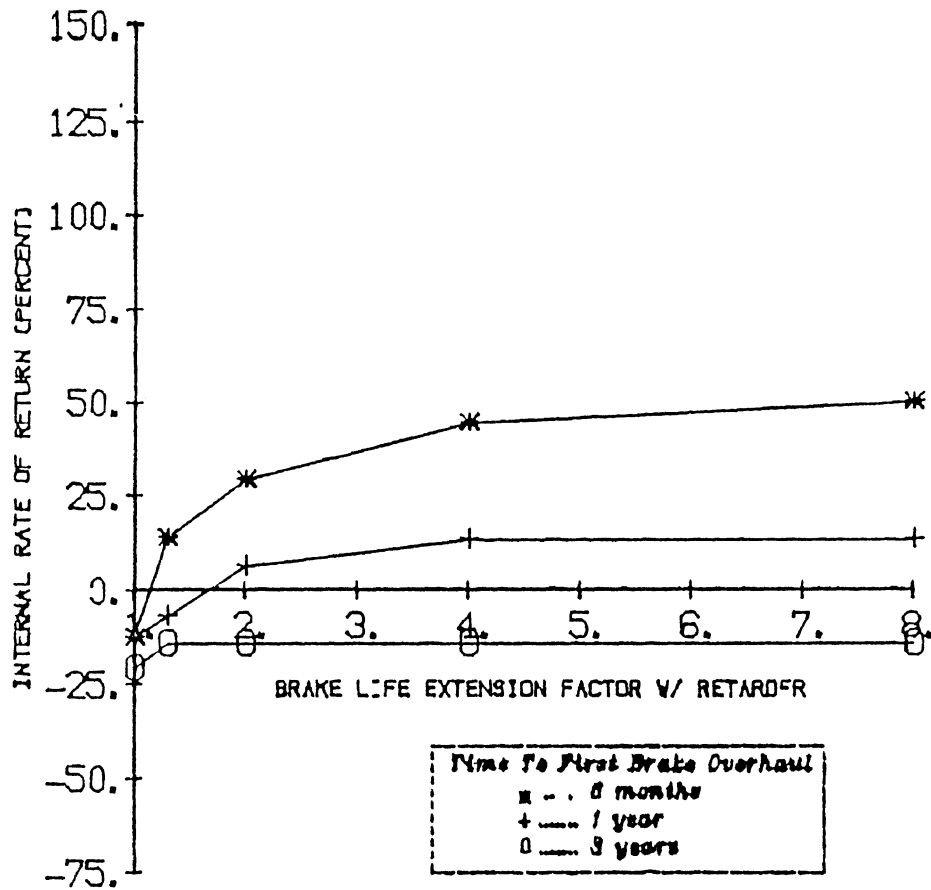
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 Expected Vehicle Life, years 10
 Total Truck Trailer Axles, number 5



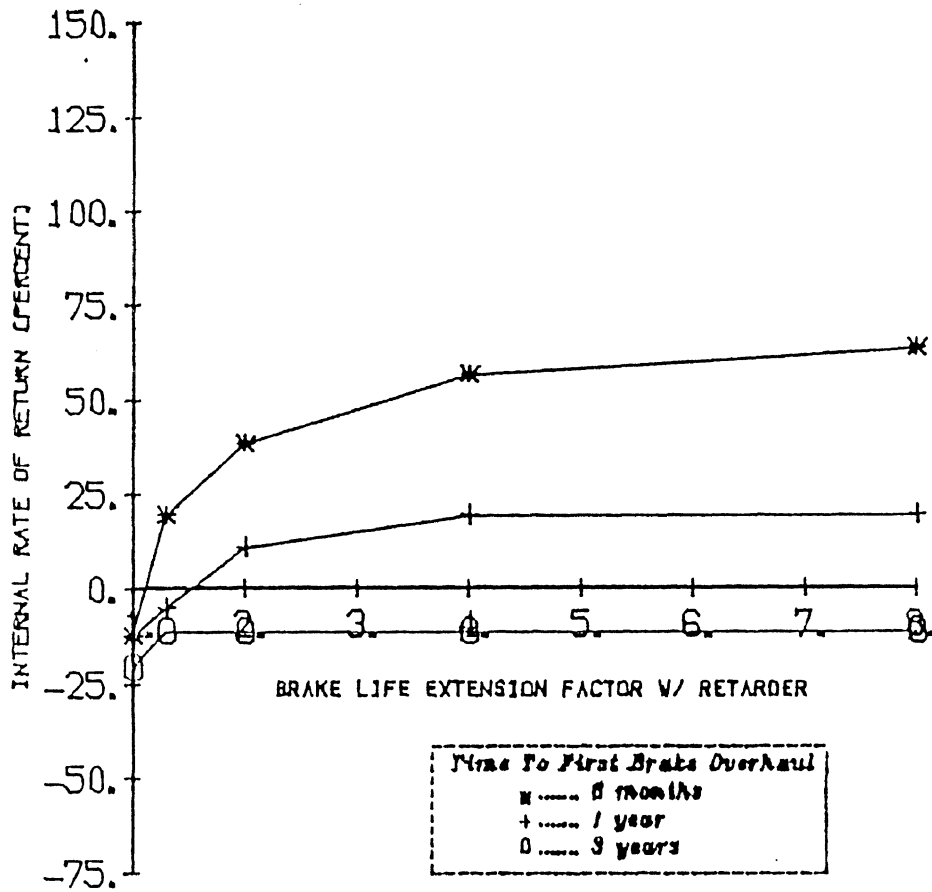
Installed Retarder Cost, dollars 3500
 Expected Vehicle Life, years 4
 Total Truck Trailer Axles, number 2



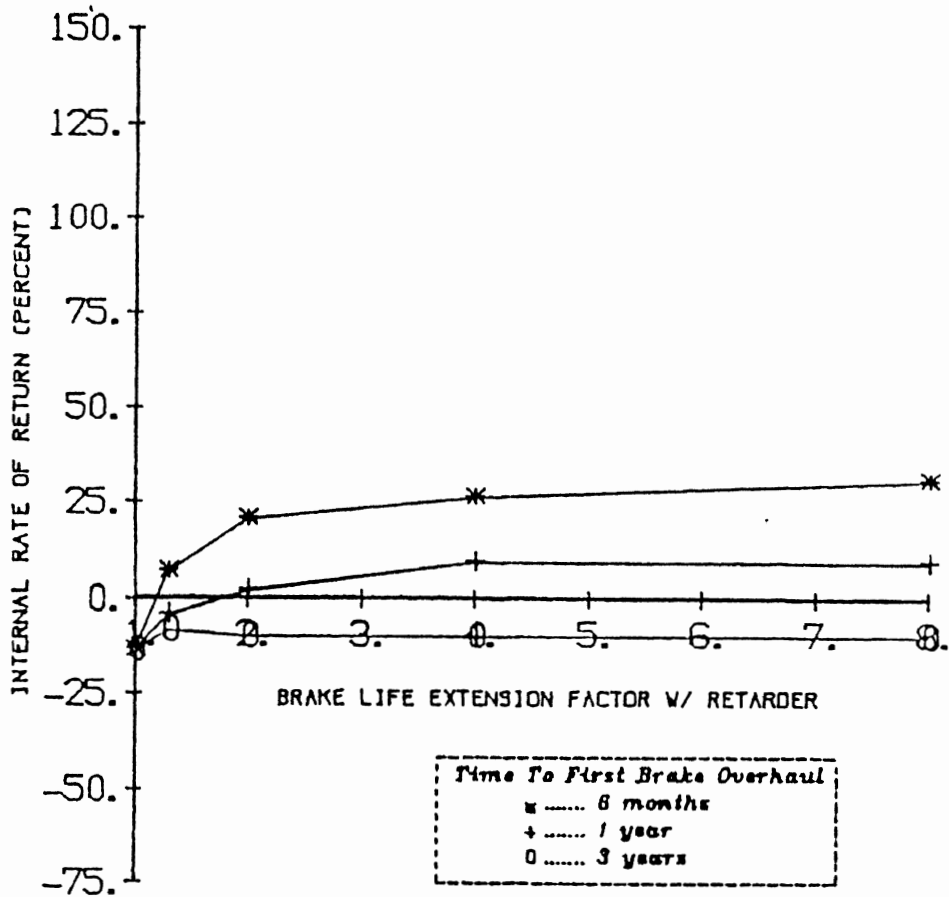
Installed Retarder Cost, dollars 3500
 Expected Vehicle Life, years 4
 Total Truck Trailer Axes, number 3



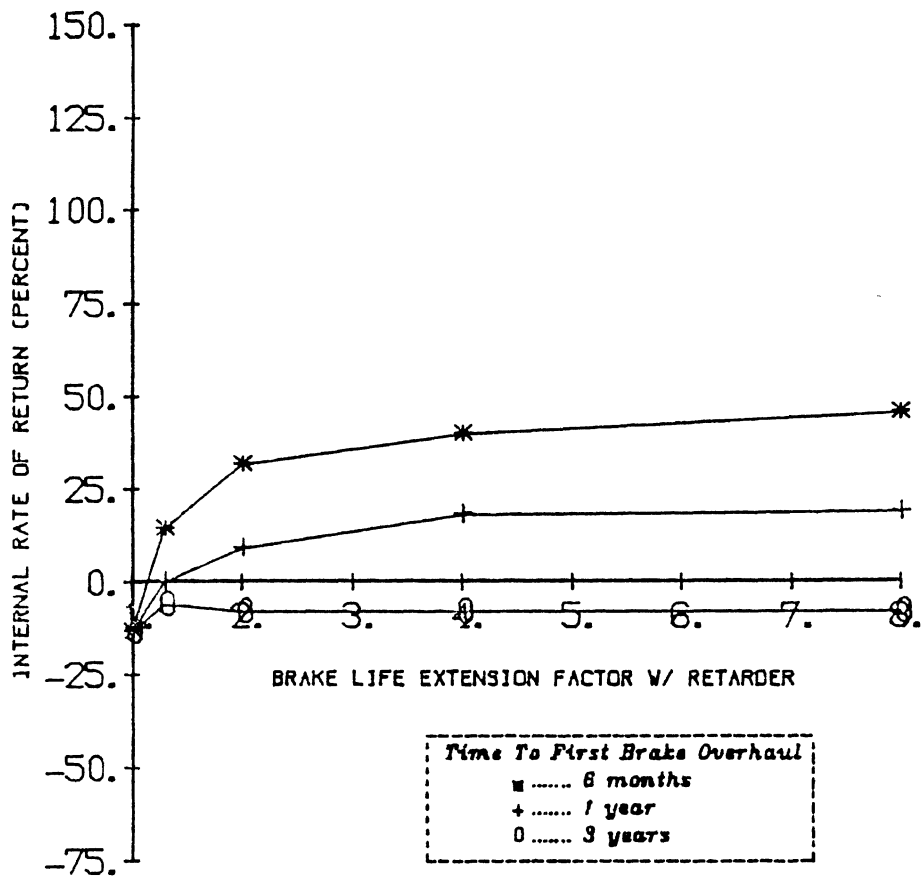
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 Expected Vehicle Life, years 4
 Total Truck Trailer Axes, number 4



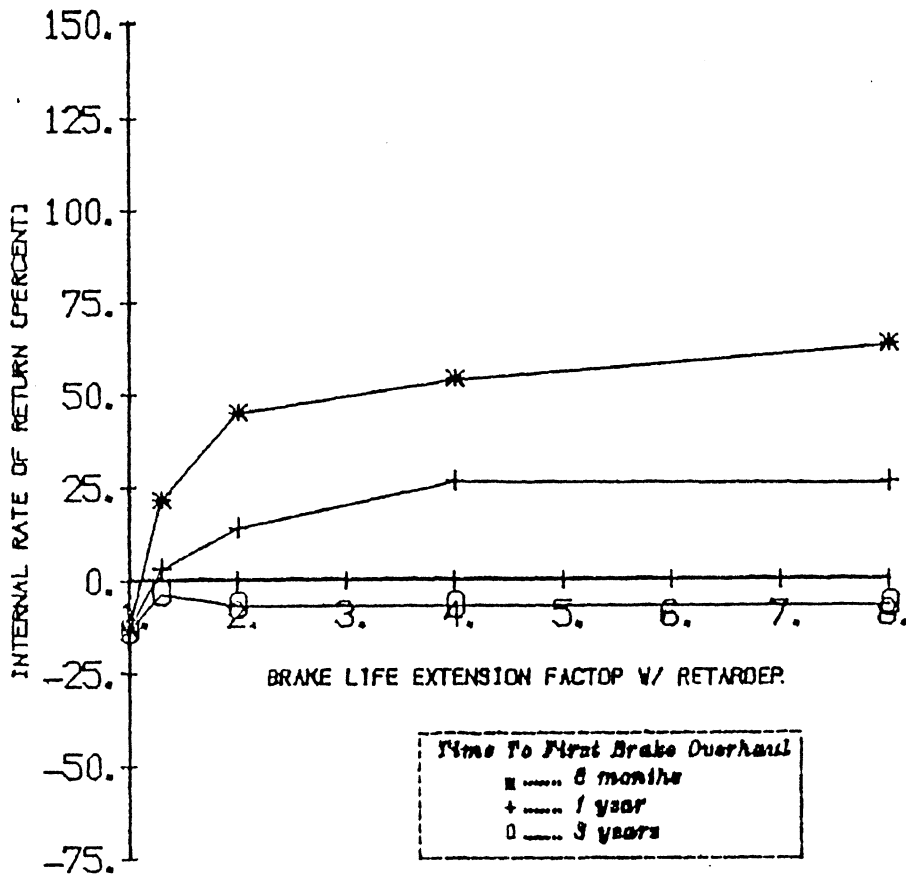
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 Expected Vehicle Life, years 4
 Total Truck Trailer Axles, number 5



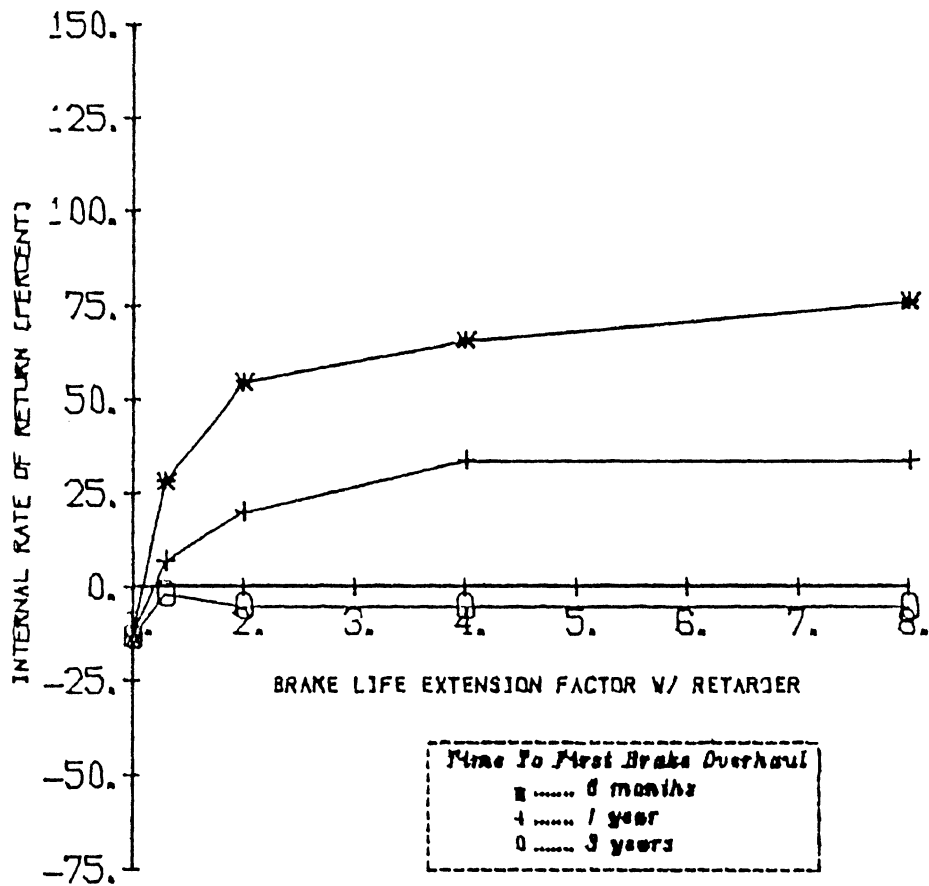
Installed Retarder Cost, dollars 3500
 Expected Vehicle Life, years 6
 Total Truck Trailer Axes, number 2



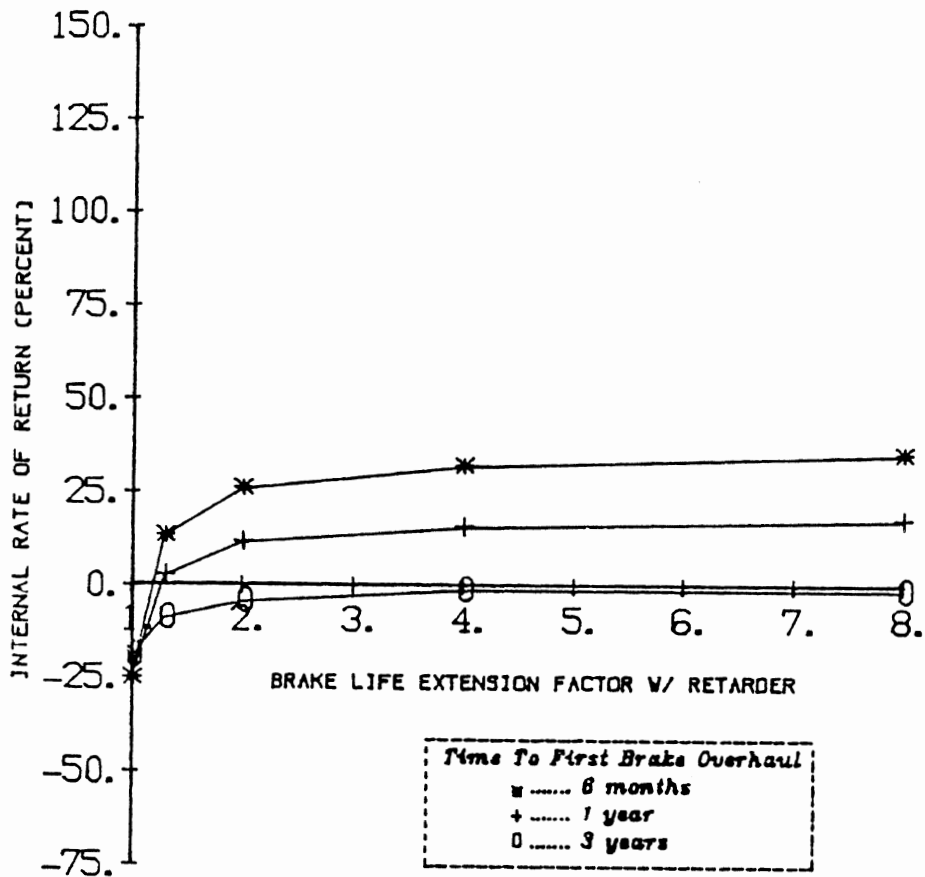
Installed Retarder Cost, dollars 3500
 Expected Vehicle Life, years 6
 Total Truck Trailer Axes, number 3



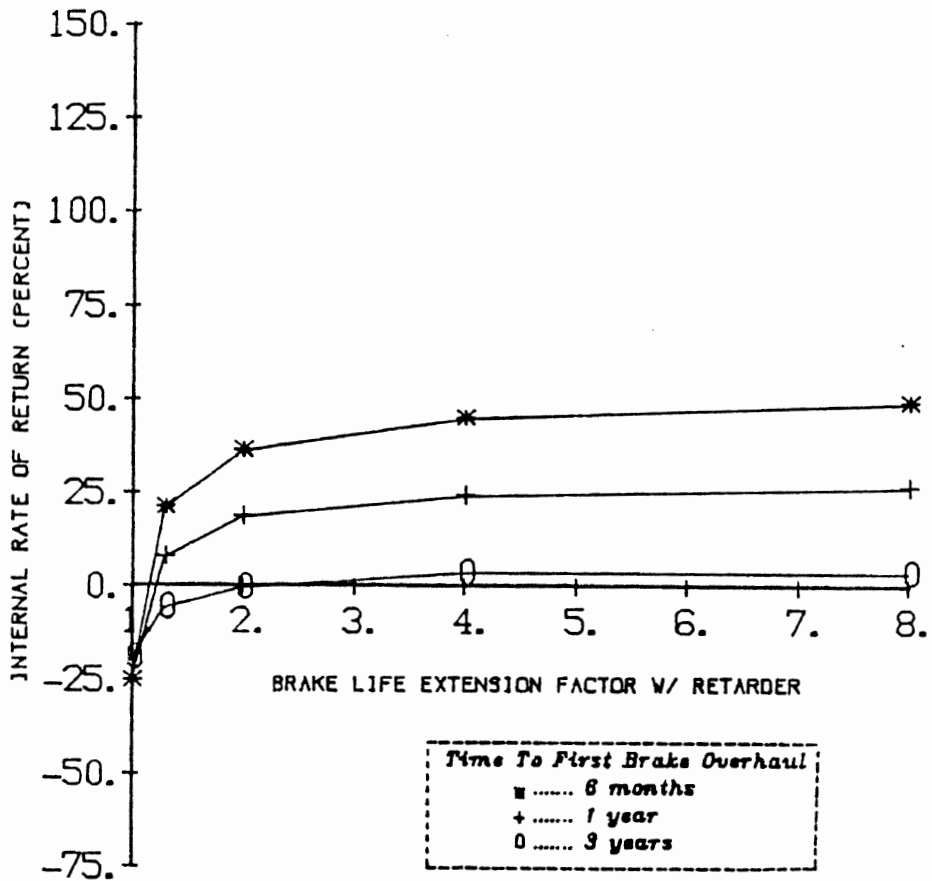
Installed Retarder Cost, dollars 3500
 Expected Vehicle Life, years 6
 Total Truck Trailer Axes, number 4



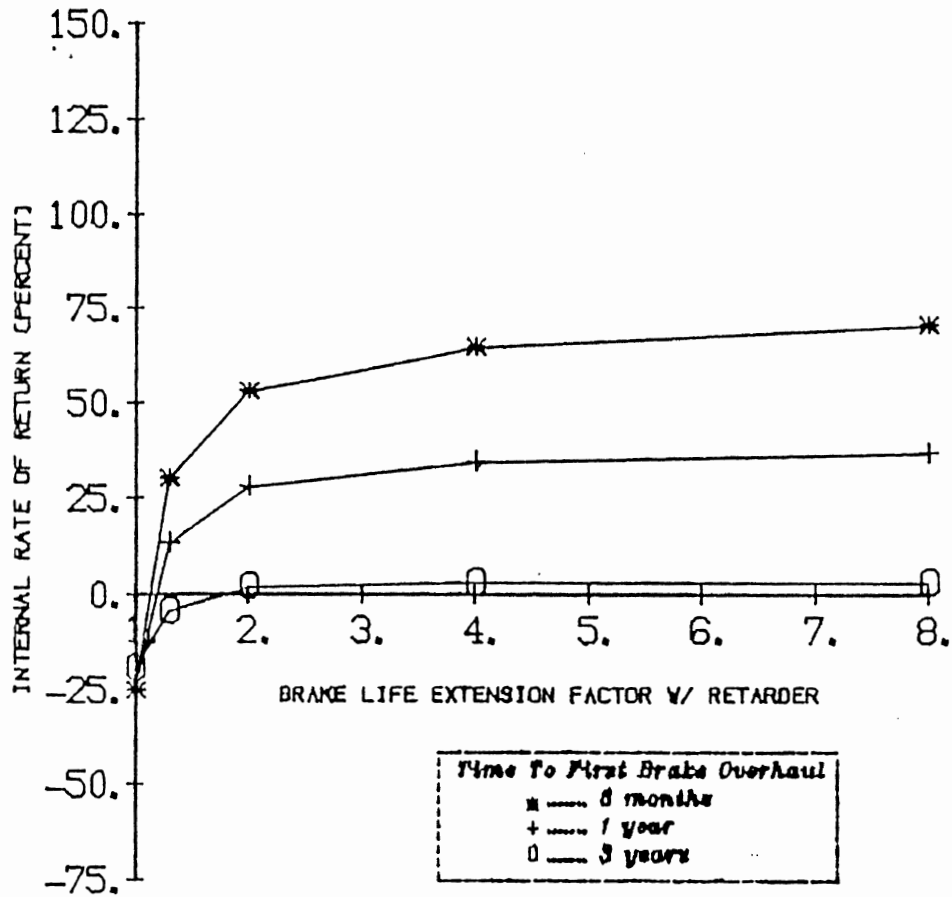
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 Expected Vehicle Life, years 6
 Total Truck Trailer Axles, number 5



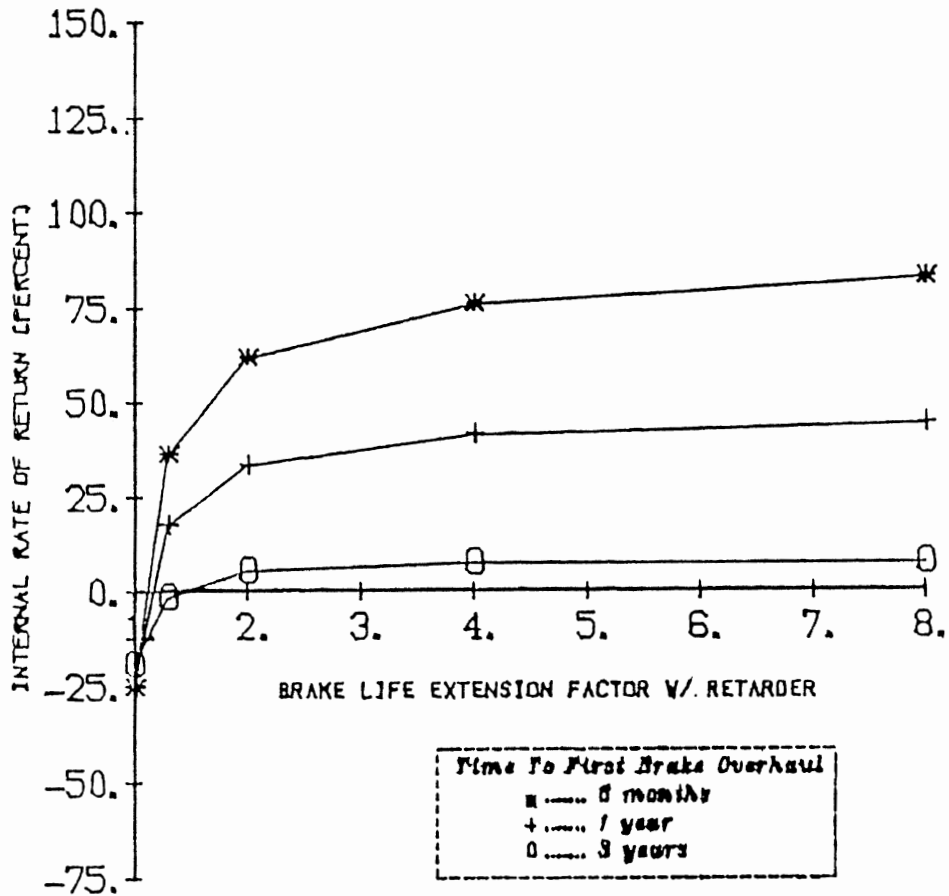
Installed Retarder Cost, dollars 3500
 Expected Vehicle Life, years 10
 Total Truck Trailer Axles, number 2



Installed Retarder Cost, dollars 3500
 Expected Vehicle Life, years 10
 Total Truck Trailer Axles, number 3



Installed Retarder Cost, dollars 3500
 Expected Vehicle Life, years 10
 Total Truck Trailer Axles, number 4



Installed Retarder Cost, dollars 3500
 Expected Vehicle Life, years 10
 Total Truck Trailer Axles, number 5

APPENDIX D

SUMMARY OF STATE INFORMATION

- Brake regulations
- Percent grades on highways
- Location of run-off ramps
- Vehicle inspection programs
- Accident data

STATE

BRAKE REGULATIONS

Pacific	Federal Motor Carrier Adopted	State Statute	Enforcement	Contact
Oregon	Brake S393.40 - 393.52 Noise S325.31 - 325.59 Emissions S325.91	S 483.444 -20 mph, 35 ft. -2 separate means of applying brake to at least 2 wheels	Oregon Public Utility Commission State Police	Oregon DOT Motor Vehicle Div. Vehicle & Equip. Safety
Washington	Brake S393.40 - 393.52	RCM 46.37.340 -20 mph, 40 ft. Cor. Decel. 14 ft/s/s -brakes on all wheels -breakaway brakes -2 means of applying	State Patrol Commission on Equip.	State Patrol Commission on Equip.
California	Brake S393.40 - 393.52	S 26301 - 26311 -20 mph - stop 40 ft. -breakaway brakes -brakes on all wheels	Highway Patrol	California Highway Patrol Commercial & Tech. Services
Hawaii			County Police	
Alaska	Brake S393.40 - 393.52		Police Officers State Troopers	Alaska State Troopers
Mountain				
Montana	Brake S393.40 - 393.52		Highway Patrol	Montana Highway Patrol
Wyoming	Brake S393.40 - 393.52	S 31-5-950 -20 mph, 40-50 ft > 10,000# (Decel. 14 ft/s/s) -brakes on all wheels -2 separate means of applying	Highway Patrol	Wyoming State Highway Patrol
Idaho	Brake S393.40 - 393.52		Highway Patrol	Idaho State Highway Patrol
Utah	Brake S393.40 - 393.52 Noise S325.31 - 325.59 Emissions S325.91		Highway Patrol	Utah State Highway Patrol

STATE	Federal Motor Carrier Adopted	State Statute	Enforcement	Contact
Mountain (Cont.)				
Colorado	Brake S393.40 - 393.52	S 42-4-220 -2 separate means of applying brakes -brakes on all wheels -20 mph - 40 ft.	Highway Patrol & Public Utilities Commission	Colorado Public Utilities Commission
Nevada	Brake S393.40 - 393.52		State Police	Nevada State Highway Patrol
Southwest				
Arizona	Brake S393.40 - 393.52 Noise S325.31 - 325.59 Emissions S325.91		Arizona Corporation Commission Police Officers	Arizona Corporation Commission
New Mexico	Brake S393.40 - 393.52 Noise S325.31 - 325.59 Emissions S325.91		State Police	New Mexico Trans. Dept. Enforcement
Texas	Brake S393.40 - 393.52	S 132 -brakes on all wheels -2 means of applying brakes -20 mph - 40 ft (decel 14 ft/s/s)	Highway Patrol	Texas State Dept. of Highways Inspection & Planning
Oklahoma				Inspection Div. Dept. of Public Safety
Midwest				
Illinois	Brake S393.40 - 393.52	S 12-301 -2 separate means of applying -brakes on all wheels -20 mph - stop in 30 ft.	State Police	Illinois Dept. of Transportation
Indiana	Brake S393.40 - 393.52	S 270 -2 separate means of applying -brakes on all wheels -20 mph - 50 ft. (14 ft/s/s)	State Police	Indiana State Police

BRAKE REGULATIONS				
STATE	Federal Motor Carrier Adopted	State Statute	Enforcement	Contact
Midwest (Cont.)				
Iowa	Brake S393.40 - 393.52	S 321.430 -2 separate means of applying brakes on all wheels -20 mph - 45 ft.	State Patrol	Iowa DOT Enforcement
Kansas	Brake S393.40 - 393.52 Noise S325.31 - 325.59	KSA 8-1734 Equip. KSA 8-1736 Maintenance KSA 8-1737 Hydraulic (Regulations were not available)	Highway Patrol	Kansas DOT
Michigan	Brake S393.40 - 393.52	S 460.16425 -brakes on all wheels -3 brakes (service, parking, emergency) -20 mph - 35 ft. (14 ft/s/s)	Michigan Public Service Commission (State Police)	
Minnesota	Brake S393.40 - 393.52	Same as Federal	State Police	Minnesota DOT Truck Equip. Enforce- ment
Missouri	Brake S393.40 - 393.52 Noise S325.31 - 325.59	Same as Federal	Public Service Commission State Police	Missouri State Highway (Enforcement)
Nebraska				Dept. of Motor Vehicles
North Dakota	Brake S393.40 - 393.52	S 39-21.32 -2 separate means -sufficient to stop vehicle	State Police	State Highway Dept.
Ohio		S 4513.20 -2 separate means of applying brakes -20 mph => 30 ft. if brakes on all wheels, else 40 ft.	State Police	Dept. of Highway Safety

BRAKE REGULATIONS

STATE	Federal Motor Carrier Adopted	State Statute	Enforcement	Contact
Midwest (Cont.)				
South Dakota	Brake S393.40 - 393.52	S 32-18-1 -20 mph → 40 mph (50 mph) 14 ft/s/s -brakes on all wheels	Highway Patrol	South Dakota Highway Patrol
Wisconsin	Brake S393.40 - 393.52	S 347.35 -2 means of applying -20 mph => 50 ft. -adequate to control vehicle	State Highway Police	Wisconsin DOT Enforcement
South				
Alabama	Brake S393.40 - 393.52	Rule No. 9 -brakes on all wheels -2 means of emergency brake operation -20 mph => 40 ft. (14 ft/s/s)	Highway Patrol	Alabama Dept. of Public Safety Highway Patrol
Arkansas	Brake S393.40 - 393.52	74-724 -2 separate means of applying -brakes on all wheels -20 mph => 50 ft. (14 ft/s/s)	State Highway Patrol	Arkansas State Highway & Transportation Dept.
Delaware	Brake S393.40 - 393.52	-adequate to control -2 separate means of applying -20 mph stop w/in 30 ft. (w/trailer => 45 ft)	State Police	Delaware Traffic Control State Police
Florida		-2 braking systems		
Georgia	Brake S393.40 - 393.52	68-1715 -2 separate means of applying -brakes on all wheels -20 mph => 30 ft. (14 ft/s/s)	State Highway Patrol	Dept. of Public Safety Inspection
Kentucky	Brake S393.40 - 393.52		State Patrol	Kentucky Bureau of Vehicle Reg. (Highway Enforcement)

STATE BRAKE REGULATIONS

STATE	Federal Motor Carrier Adopted	State Statute	Enforcement	Contact
South (Cont.)				
Louisiana			State Police	Louisiana State Police Dept. of Public Safety
Maryland	Brake S393.40 - 393.52	S 22-301 -brakes on all wheels -2 means of applying	State Police	Auto Safety Enforcement State Police
Mississippi	Brake S393.40 - 393.52 Noise S325.31 - 325.59 Emissions S325.91		Highway Patrol Public Service Commission	Traffic Enforcement Highway Safety Patrol
North Carolina	Brake S393.40 - 393.52	S 30-124 -2 separate means of applying -20 mph => 30 ft (both brakes) 50 ft (1 brake)	State Patrol	North Carolina Div. of State Highway Patrol
South Carolina	Brake S393.40 - 393.52			South Carolina Highway Patrol
Tennessee	Brake S393.40 - 393.52		State Patrol Public Service Commission	Tennessee Public Service Commission (Motor Carrier Div.)
Virginia	Brake S393.40 - 393.52	S 46.1-277 -20 mph => 40 ft (50 ft)	State Police	Virginia State Police (Safety)
West Virginia	Brake S393.40 - 393.52		State Police	W. Virginia Dept. of Public Safety
Northeast				
Connecticut				
Maine	Brake S393.40 - 393.52	-brakes on all wheels	State Police	Maine State Police
Massachusetts	Brake S393.40 - 393.52		State Police	Massachusetts Registry of Motor Vehicles
New Hampshire	Brake S393.40 - 393.52	S 263:5 -20 mph = 30 ft.	State Police	New Hampshire Div. of Motor Vehicles

STATE	BRAKE REGULATIONS			
Northeast (Cont.)	Federal Motor Carrier Adopted	State Statute	Enforcement	Contact
New Jersey	Brake S393.40 - 393.52		State Police	Traffic Division New Jersey State Police
New York	Brake S393.40 - 393.52	S 41.1 -20 mph = 30 ft (brakes on all wheels - else 45 ft)	State Police	New York Dept. of Motor Vehicles (Vehicle Safety)
Pennsylvania				
Rhode Island				
Vermont	Brake S393.40 - 393.52	S 1307 -2 separate means of applying -brakes on all wheels	State Police Motor Vehicle Inspectors State Patrol	State Police Vermont Dept. of Motor Vehicles Agency of Trans.

STATE	INSPECTION	Frequency	Where	Brakes	Emissions	Noise	Contact
Pacific Oregon		N/R (Random Spot Ins.)				Small towns prohibit vehicles with retarders	Oregon DOT - Motor Vehicle Div. Vehicle & Equip. Safety
Washington		N/R (Random Spot Ins.)			Ringlemann Smoke Chart	Small towns prohibit vehicles with retarders Vehicles subject to noise test on hwy.	Washington State Police Weight Control Div.
California		N/R TARP Program (Random Spot Ins.)	Along highway			Measurement regulations exist	Dept. of California Highway Patrol
Hawaii		Yearly					
Alaska		N/R			Regulations not enforced	Small towns prohibit Jake brakes	Alaska State Troopers
Mountain							
Montana		N/R			No regulations	Regulations never enforced	Montana Highway Patrol
Wyoming		N/R			No regulations	No regulations	Wyoming State Highway Patrol Safety & Training
Idaho		N/R			No regulations	90 dB regulation	Idaho State Highway
Utah		Yearly Utah Truck Inspection Prog.	State Inspection Stations	20 mph - 60 ft Visual & mechanical inspection of entire brake system			Utah Truck Inspection Program Dept. of Public Safety
Colorado		Yearly	Certified Stations Test Areas	Visual & mechanical - entire brake system	No regulations	Noise level must not be excessive	Colorado Dept. of Revenue Enforcement Service

INSPECTION

STATE	Frequency	Where	Brakes	Emissions	Noise	Contact
Mountain (Cont.)						
Nevada	N/R			State emission regulations Tested at certified stations	<35 mph - 88 dBA >35 mph - 90 dBA 50 ft from vehicle measured along highway	Nevada State Highway Patrol
Southwest						
Arizona	N/R					Arizona Corporation Commission
New Mexico	N/R					New Mexico Transportation Dept. Enforcement
Texas	Yearly	Certified Stations		State is developing emission regulations	No regulations	Texas State Dept. of Highways Inspection & Planning
Oklahoma	Yearly	Certified Stations	Visual inspection of brakes			Inspection Div. Dept. of Public Safety
Midwest						
Illinois	6 Months (Commercial veh. only)		Visual & mechanical			Illinois Dept. of Transportation (Inspection)
Indiana	Yearly					Indiana State Police (Inspection)
Iowa	N/R					Iowa DOT (Enforcement)
Kansas	N/R (Random spot ins.)					Kansas Highway Patrol
Michigan	N/R (Random spot ins.)					Michigan Public Service Commission

STATE	INSPECTION					Contact
	Midwest (Cont.)	Frequency	Where	Brakes	Emissions	
Minnesota		N/R (Random spot ins.)				Minnesota Dept. of Public Safety (State Patrol)
Missouri		Yearly	Certified Stations	Visual & mechanical	Inspect exhaust system for leaks	Missouri State Highway Patrol
Nebraska		Yearly	Certified Stations	Visual & mechanical Brake defect = 28% rejection of 10% sample	Inspect muffler	Nebraska Dept. of Motor Vehicles
North Dakota		N/R				North Dakota State Highway Dept.
Ohio		N/R (Random spot ins.)				Ohio Dept. of Highway Safety
South Dakota		N/R				Dept. of Public Safety (Highway Patrol)
Wisconsin		N/R				Wisconsin DOT (Enforcement)
South						
Alabama		N/R			"No excess smoke"	Alabama Highway Patrol
Arkansas		Yearly	Certified Stations	Stopping test Visual & mechanical inspection	Visual inspection of muffler	Arkansas State Police
Delaware		Yearly	State Institutions	Drive & stop test on brake machine		Delaware State Police
Florida		Yearly	Certified Inspection Stations			

STATE	INSPECTION					
South (Cont.)	Frequency	Where	Brakes	Emissions	Noise	Contact
Georgia	Yearly	Certified Stations	Visual & mechanical inspection -Road test -Remove wheel	No "annoying smoke"	No "excessive noise"	Georgia Dept. of Public Safety (Inspection)
Kentucky	N/R			Regulated by EPA	"Must operate with a muffler"	Kentucky Bureau of Vehicle Regulations (Hwy. Enforcement)
Louisiana	Yearly					Louisiana State Police Dept. of Public Safety
Maryland	N/R		Stopping distance Detailed inspection Visual & mechanical	Regulations to go into effect 1983	Actively enforced	Auto Safety Enforcement State Police
Mississippi	Yearly	Certified Stations	Stopping distance only 20 mph => 30 ft.			Traffic Enforcement Highway Safety Patrol
North Carolina	Yearly	Certified Stations	Visual inspection -Road test	Cannot emit visible contaminants for more than 5 sec.	Prohibit "excessive noise"	North Carolina State Highway Patrol (Traffic Safety)
South Carolina	Yearly					South Carolina Highway Patrol
Tennessee	N/R					Tennessee Public Service Commission Motor Carrier Div.
Virginia	6 months	Certified Stations	Visual & mechanical inspection			Virginia State Police (Safety)
West Virginia	Yearly	Certified Stations			No "loud noise"	W. Virginia Dept. of Public Safety

STATE	Frequency	Where	Brakes	Emissions	Noise	Contact
INSPECTION						
Northeast						
Connecticut						
Maine	6 months	Certified Stations	Visual inspection			Maine State Police
Massachusetts	6 months	Certified Stations	-Road test -Stop 20 mph = 35 ft.			Massachusetts Registry of Motor Vehicles (Inspection)
New Hampshire	6 months	Certified Stations	Mechanical & visual inspection			New Hampshire Div. of Motor Vehicles
New Jersey	Yearly					Traffic Division New Jersey State Police
New York	Yearly (Buses - 6 mo.)	Certified Stations	Visual inspection	Equipment in "good working order"	>19000# 35 mph 86 dB >35 mph 90 dB	New York Dept. of Motor Vehicles (Vehicle Safety)
Pennsylvania	6 months	Certified Stations	Visual & mechanical inspection (See Handbook)			Pennsylvania DOT (Traffic Safety)
Rhode Island	Yearly					
Vermont	6 months	Certified Stations	Visual & mechanical inspection (See Handbook)			State Police Vermont Dept. of Motor Vehicles Agency of Trans.

STATE

RUNOFF RAMPS

Pacific	Number	Location	Statistics	Accident Reports	Future Proposals	Contact
Oregon	5	I-80 N. W/B #1 I-80 N. W/B #2 Emigrant Hill OR-58 W/B #1 Willamette Pass OR-58 W/B #2 Willamette Pass I-5 N. W/B Siskiyou Summit	State not informed of ramp users Design & testing report Drawings for Siskiyou	Siskiyou Ramp = 10/1 - 1/15 8/1 - 8/14 1978 12/1 - 12/5 1979 wt, speed, cause, damage	Under construction Mt. Hood Highway	Oregon DOT Highway Division Design
Washington	1	US-12 Alpowa Summit				Washington DOT Design
California	3	I-5 W/B Klamath Siskiyou County CA-2 S/B La Canada L.A. County I-8 San Diego County	I-8 - Traffic flow avail. Opened March '78 Used 24 times	3 fatal accident reports	I-80 Sierras CA-52 Central Calif. CA-299 Northern Calif.	California DOT Office of Planning & Design
Hawaii	4	2 - Pali Highway 2 - Lifelike Highway	Not kept		No	Hawaii DOT Design
Alaska	2	North of Skagway	New Highway - Not open to public yet (Grades are 6-8%)		No	Alaska DOT Highway Construction
Mountain						
Montana	1	Highway 287 - Virginia City	5-6% grade Design & testing report for 287 & I-90		Constructing a ramp Homestate Pass I-90	Montana Highway Dept. Highway Road Design
Wyoming	3	US-16 E/B W. of Buffalo US-16 E/B W. of Buffalo US-16 W/B E. of Tensleep	Trucks usually equipped with retarders 7% grades		No	Wyoming State Highway Patrol Division C

STATE RUNOFF RAMPS

Mountain (Cont.)	Number	Location	Statistics	Accident Reports	Future Proposals	Contact
Idaho	7	US-95 Bonners Ferry US-95 Lewiston US-95 Lewiston US-95 Lewiston US-95 White Bird US-95 White Bird US-95 White Bird	Design & testing report	Record of each time ramp is used Wt, speed, cause, damage	No	Idaho DOT Research
Utah	2	I-80 Parley's Canyon US-91 Brigham City				Utah DOT Roadway Design
Colorado	5	US-40 Rabbit Ears Pass I-70 Vail Pass I-70 Vail Pass I-70 Mt. Vernon Canyon US-160 Wolf Creek Pass		Record of each time ramp is used Wt, speed, cause, damage	Under construction I-70 Straight Creek SH-141 Slick Rock Hill US-160 Wolf Creek Pass	Colorado Div. of Highways Traffic & Safety
Nevada	3	2 on US-50 1 on SR-431	Location & construction drawings Grade information		2 more under construction	Nevada DOT Planning & Safety
Southwest						
Arizona	1	S.E. part of State near Douglas	Not kept		Considering another ramp near Globe	Arizona DOT Construction
New Mexico	2	US-70 US-70	Ramp used only once	Newspaper article of recent accident	No	New Mexico Public Affairs
Texas	2	Near El Paso	Installed Feb. '79 6-7% grade 3 mi.		No	Texas Dept. of Highways District 24
Oklahoma	0					Traffic Eng. Div. Oklahoma DOT

RUNOFF RAMPS

STATE	Number	Location	Statistics	Accident Reports	Future Proposals	Contact
Midwest						
Illinois	0					Illinois Dept. of Trans. (Design)
Indiana	0					Indiana State Police
Iowa	0				Considering US-18 West of Marquette	Iowa DOT (Road Design)
Kansas	0					Kansas DOT (Design)
Michigan	1	M-72 Traverse City	Never used		No	Michigan DOT
Minnesota	0					Minnesota DOT (Road Design)
Missouri	0					Missouri Highway Patrol Public Safety
Nebraska	0					Nebraska Dept. of Roads
North Dakota	0					North Dakota State Highway Dept.
Ohio	0					Ohio DOT - Location & Design
South Dakota	2	US-16 Rapid City US-385 Deadwood	Ramps never been used		Considering	Div. of Highways District Engineer
Wisconsin	0					Wisconsin DOT (Design)
South						
Alabama						
Arkansas	0					FHA Report (Emergency Escape Ramps)
Delaware	0					FHA Report (Emergency Escape Ramps)

RUNOFF RAMPS							
STATE	South (Cont.)	Number	Location	Statistics	Accident Reports	Future Proposals	Contact
Florida		0					Florida Highway Patrol
Georgia		0					FHWA Report TS-79-201 (Emergency Escape Ramps)
Kentucky		0				Junction Kentucky 118 & 80 Daniel Boone Pkwy. to Hyden (2 mi. downgrade 7-9%)	Kentucky DOT (Traffic)
Louisiana		0					FHWA Report TS-79-201 (Emergency Escape Ramps)
Maryland		0					FHWA Report TS-79-201 (Emergency Escape Ramps)
Mississippi		0					FHWA Report TS-79-201 (Emergency Escape Ramps)
North Carolina		9	3: I-40 Old Fort & Ridgecrest 1: US-221 Marion & Spruce Pine 1: US-64 Franklin 2: US-23-441 Dillsboro & Franklin 2: US-421 Wilkes Co.	Published write-up on ramps	Yes		North Carolina DOT (Traffic)
South Carolina		0					FHWA Report TS-79-201 (Emergency Escape Ramps)
Tennessee							Tennessee DOT (Traffic)
Virginia							
West Virginia		2	US-48 Morgan Town US-48 Morgan Town	Statistics not kept (Towing not necessary)		US-52 near Mercer Co.	W. Virginia Dept. of Highways - Community & Env. Affairs

RUNOFF RAMPS

STATE	Number	Location	Statistics	Accident Reports	Future Proposals	Contact
Northeast Connecticut	0					FHWA Report TS-79-201 (Emergency Escape Ramps)
Maine	0					FHWA Report TS-79-201 (Emergency Escape Ramps)
Massachusetts	0					FHWA Report TS-79-201 (Emergency Escape Ramps)
New Hampshire	0					New Hampshire Dept. of Public Works & Highways
New Jersey	2	Route 206				New Jersey DOT Design
New York	2	NY-10 Richmond- ville NY-28 Vickerman Hill	Accident history report for Vickerman Hill		Locke-Homer Area	New York DOT (Traffic Eng.)
Pennsylvania	9	US-219 Boot Jack Hill US-219 Boot Jack Hill US-422 Kittanning US-40 Uniontown US-30 Sidetong Hill US-30 Franklin Co. PA-93 Nesquehoning PA-115 Wilkes Barre PA-115 Wilkes Barre	Traffic study Newspaper articles Information on construction and use of ramps	Accident reports on users of ramps (detailed)	Route 8 & 62 Franklin US-119 Punxyutawney Armstrong Co. outside Freeport	Pennsylvania DOT (Traffic Eng.)
Rhode Island	0					FHWA Report TS-79-201 (Emergency Escape Ramps)
Vermont	3	SR-9 Woodford SR-9 Searsburg SR-9 Searsburg	Traffic flow Searsburg 2390 6% are Woodford 2830 trucks Never been used		Considering a ramp near Northfield & West of Searsburg & in Barre	Vermont Agency of Transportation (Survey & Plans)

STATE	ACCIDENT DATA		
Pacific	Accidents/Brake Defect	Specific Data	Contact
Oregon			
Washington		Gross Wt. > 10,000#	Oregon DOT Motor Vehicle Div.
	1978	235 (4.1%) brake failure	Washington State Police
		5717 total accidents	Accident Records Div.
California		Trucks	California Highway Patrol
	1978	258 brake failure	Mgmt. Info. System
		10,805 total accidents	
	1977	174 brake failure	
		9,248 total accidents	
Hawaii		Runaway Vehicle Accidents	Hawaii DOT Traffic Eng.
		1977 - 1	
		1978 - 1	
		1979 - 2	
Alaska			Alaska DOT Traffic & Safety Eng.
Mountain			
Montana			Montana Highway Dept. Planning & Research
Wyoming		See Runaway Accident Reports	
Idaho		All Vehicles	Idaho DOT Traffic
	1978	171 brake defect	
		29,695 total accidents	
		51,700 vehicles involved	
Utah		N/A	Utah DOT Safety
Colorado		Statistics available from J. O'Day	Colorado Dept. of Highways Highway Safety

STATE	ACCIDENT DATA				Contact
Montain. (Cont.)	Accidents/Brake Defect	Specific Data			
Nevada	Statistics not listed by brake defect				Nevada State Highway Patrol
Southwest					
Arizona	Statistics not listed by brake defect				Arizona DOT Safety Projects Serv.
New Mexico	N/A				New Mexico State Police
Texas	All Vehicles				Texas Dept. of Public Safety Statistics
	Brake Defect	Total Accidents			
	25	3,468			
	1978 Fatal				
	Nonfatal	5,306	426,296		
Ok lahoma	1979 All Vehicles				Services & Records Dept. of Public Safety
	Brake defect 1,049				
	Total # accidents 149,745				
Illinois	N/A				Illinois Dept. of Trans. (Data Analyst)
Indiana	N/A				Indiana State Police
Iowa	N/A				Iowa DOT (Safety Prog.)
Kansas	1978 All Vehicles				Kansas DOT (Safety)
	Brake Defect	Total			
	1,274	134,820			
	All Accidents				
	Fatal	4	772		
	Injury	440	40,859		
Michigan					Michigan DOT Safety
Minnesota					Minnesota Dept. of Public Safety (Traffic Safety)

STATE	ACCIDENT DATA			Contact
Midwest (Cont.)	Accidents/Brake Defect	Specific Data		
Missouri	N/A			Missouri State Highway Dept.
Nebraska	1978 All Vehicles Brake Defect Total			Nebraska Dept. of Roads (Accidents)
	All Fatal Injury	34 1,151 3 21 17 422		
North Dakota	N/A			North Dakota Highway Dept. (Traffic)
Ohio	1978 All Vehicles Tickets Defective Brakes 7,735 Total Vehicles 800,003			Ohio Dept. of Highway Safety Statistics
South Dakota	Defective Brakes (Semis) 1978 - 15 1979 - 7			Dept. of Public Safety (Accident Records)
Wisconsin	Book with all accidents facts for Wisconsin (1978)			Wisconsin DOT (Accident Data)
South				
Alabama	1978 Defective Brakes (All) Fatal Injury Prop. Dam. Total	14 509 1896 Total 24,019	Total # Accidents 128,272	Alabama Dept. of Public Safety (Data Processing)
Arkansas			Computer printout Accidents with trucks due to brake failure on a grade	Arkansas Dept. of Public Safety (Highway Safety)
Delaware	1979 - 35 accidents due to brake failure - all vehicles			Delaware State Police Traffic Control
Florida				

STATE	ACCIDENT DATA		
South (Cont.)	Accidents/Brake Defect	Specific Data	Contact
Georgia	N/A		Georgia Dept. of Public Safety (Accident Reporting)
Kentucky	N/A		Kentucky Bureau of Vehicle Regulations (Highway Enforcement)
Louisiana	1978 All Vehicles Brake defect 3,111 Total # accidents 170,201		Traffic Records Dept. of Public Safety
Maryland	Accidents Due to Brake Failure Trucks Jan. 1-Apr. 1, 1980 - 2 July 1-Dec. 31, 1979 - 6 Jan. 1-June 30, 1979 - 6		Auto Enforcement State Police
Mississippi	1979 All Vehicles Faulty Equip. 254 Total Accidents 38,967		Statistic Bureau Dept. of Public Safety
North Carolina	1978 All Vehicles Brake Defect 3,145 Total 275,945		North Carolina Div. of Motor Vehicles Traffic Records
South Carolina	1979 All Vehicles Inadequate Brakes 807 Total # Accidents 97,394		Accidents Research Dept. of Highway Safety
Tennessee	Cost?		Tennessee DOT Research & Planning
Virginia		Virginia Crash Facts 1978	Virginia Dept. of Highways (Traffic & Safety)
West Virginia	N/A		W. Virginia Dept. of Highways

STATE	ACCIDENT DATA			Contact
	Accidents/Brake Defect	Specific Data		
Northeast				
Connecticut	1978 All Vehicles			Connecticut DOT Accident Records
	Brake Defect 728			
	Total # Accidents 101,264			
Maine	N/A			Maine State Police
Massachusetts	N/A			Massachusetts Registry of Motor Vehicles (Statistics Section)
New Hampshire	N/A			New Hampshire Div. of Motor Vehicles
New Jersey				
New York	1978 Truck Accidents			New York Div. of Motor Vehicles
	Brake Failure 592			Accident Records
	Total 55,675			
Pennsylvania	N/A			Pennsylvania DOT (Traffic Control)
Rhode Island	1979 All Vehicles			Rhode Island DOT Accident Statistics
	Brake Defect 828			
	Total # Accidents 47,000			
Vermont				

PERCENT GRADE

STATE	Percent Grades	Locations	Map	Contact	Comments
Pacific Oregon	> 5%	Listing of Route & Location		Western Highway Institute	All vehicles in Portland metro area must pass bi-annual emissions test*
Washington	> 5%	Listing of Route & Location		Western Highway Institute	
California	> 4% & > 2 mi. or > 5%	Listing of Route & Location	Locations of highways with grades > 4% for 2 mi. or more	California Dept. of Public Works Div. of Highways (Western Highway Institute)	School buses required to be inspected yearly* 9 inspection facilities in State
Hawaii				Hawaii DOT Highway Design Eng.	
Alaska				Alaska DOT Planning & Research	
Mountain					
Montana	> 5%	Listing of Route & Location		Western Highway Institute	School buses required to be inspected twice a year by State Highway Patrol*
Wyoming	> 5%	Listing of Route & Location		Wyoming State Highway Dept. - Planning	
Idaho	(> 5%)	(Listing of Route & Location)		Idaho DOT- Roadway Design (Western Highway Institute)	
Utah	> 5%	Listing of Route, Location & Distance	Map of routes with grade information	Utah DOT Planning	
Colorado	> 5%	Listing of Route & Location		Western Highway Institute	
Nevada	(> 5%)	(Listing Route & Location)		Nevada DOT - Planning & Safety (Western Highway Institute)	

PERCENT GRADE

STATE	Percent Grades	Locations	Map	Contact	Comments
Southwest		Listing of Route & Location	Map		
Arizona	> 5%	Listing of Route & Location		Western Highway Institute	School buses required to be inspected annually*
New Mexico	> 5%	Listing of Route & Location	Traffic Flow Map	Western Highway Institute	Schools inspected twice a year* Commercial vehicles inspected at point of entry*
Texas	N/A			Texas Dept. of Highways Highway Design	
Oklahoma	1 section w/grade > 5% Highway 1 between Tallihia & Arkansas State Line ADT = 50-115			Oklahoma DOT Traffic Eng.	
Midwest					
Illinois	Most of State highways < 4%			Illinois Dept. of Transportation (Location & Environment)	
Indiana	Most State Highways < 4%			Indiana State Highway Comm.	
Iowa	Most of State Highways < 4%			Iowa DOT Road Design	Inspection required at sale of vehicle (new & used)*
Kansas	Most State highways < 5%			Kansas DOT (Design)	Inspection required at sale of used car & 1st time registration (new vehicles exempt)
Michigan	N/A			Michigan DOT	Buses required to be inspected each year*
Minnesota	Grades < 5%			Minnesota DOT Road Design	School buses inspected semi-annually*

STATE	Midwest (Cont.)	Percent Grade	Locations	Map	PERCENT GRADE	Contact	Comments
Missouri		N/A				Missouri State Highway Dept.	
Nebraska						Nebraska Dept. of Roads (Design)	Some local ordinances on noise control
North Dakota						North Dakota Highway Dept.	
Ohio		Grades > 5%	SR-32 East of SR-73 SR-39 West of SR-7 US-36 East of US-62 SR-32 East of Adams Co. Line			Ohio DOT - Location & Design	
South Dakota		N/A				Div. of Highways (District Eng.)	Some cities have noise level requirements (Sioux Falls, Rapid City)
Wisconsin		Interstate Grades < 5%				Wisconsin DOT (Design)	Used vehicles must be inspected prior to sale* School buses must be inspected*
Alabama		> 5% 1 mi. or more	Listing of Route & Locations	Map of Route Locations		Alabama Highway Dept.	Cities may have inspection stations*
Arkansas							
Delaware		N/A				Delaware State Police - Traffic Control	
Florida						Florida DOT	
Georgia		N/A				Georgia DOT - Planning Data Service	
Kentucky		N/A				Kentucky DOT (Design)	Louisville has more stringent emissions regulations

STATE	PERCENT GRADE	Locations	Map	Contact	Comments
South (Cont.)	Percent Grades	Locations	Map	Contact	Comments
Louisiana	> 5%		Engineering Design Plans sent	Louisiana DOT Planning Div.	
Maryland	> 5%	Maryland 135 between US-219 & US-220 8 mi. downgrade US-40 west of 70		Highway Statistics State Hwy. Adm.	Vehicles inspected upon sale or transfer of ownership
Mississippi				Highway Dept. Trans. Design & Planning	
North Carolina	N/A			North Carolina DOT (Traffic Eng.)	
South Carolina	N/A			South Carolina Dept. of Highways - Traffic Planning	Do not inspect vehicles registered under ICC exempt house trailers*
Tennessee	Cost?			Tennessee DOT Research & Planning	
Virginia	N/A			Virginia Dept. of Highways (Traffic & Safety)	
West Virginia	N/A			W. Virginia Dept. of Highways	Contact Dr. Eck of W. Virginia Univ. School of Eng., Morgantown, W. Va. for grade information
Northeast					
Connecticut	N/A			Connecticut DOT - Div. of Design	Inspect* - Used vehicles registered for first time (20% - Vehicles >10 yrs upon transfer vehicles) - school buses
Maine				Maine DOT (Design)	
Massachusetts	N/A			Massachusetts Dept. of Public Works - Div. of Maintenance	

STATE	PERCENT GRADE	Locations	Map	Contact	Comments
Northeast (Cont.)	Percent Grade	Locations	Map	Contact	Comments
New Hampshire	20 locations where highway grade > 5% for > 1 mi.			New Hampshire Dept. of Public Works & Highways	
New Jersey				New Jersey DOT - Design	Vehicles > 6000#'s can elect to self-inspect Buses inspected every 6 mo.
New York					
Pennsylvania			Hazardous hill map (Locations of potential prob. areas)		
Rhode Island	N/A			Rhode Island DOT - Design	
Vermont	4 - 8%	US-4 E. of Rutland V-9 Bennington-Brattleboro V-11 Jamaica area V-62 Barre area I-89 Burlington-Montpelier V-105 Jay area		Vermont Agency of Transportation (Planning)	

*Source: Summary of State Motor Vehicle Inspection Laws and Regulations, 1979 Edition, MVMA

APPENDIX E

TYPICAL ACCIDENT REPORT NARRATIVE
FROM A COMMERCIAL OFFICER
ON A RUNAWAY TRUCK

TYPICAL ACCIDENT REPORT NARRATIVE
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Upon my arrival at scene at approximately 1500 hours, I observed a noticeable amount of smoke coming from right side wheels on both axles on trailer. At approximately 1655 hours, I examined trailer brakes and observed they were applied with full pressure from air tank on trailer, and still warm to the touch. In cursory examination of spring brakes, I observed that they were in the applied position on both wheels of #3 axle.

The tow truck in its initial towing of vehicle #1 pulled it ahead approximately 20 feet from POR without releasing spring brakes and I observed that the wheels on the spring brake axle, #3, on the right side would not turn but the left side did turn.

Inspection:

On March 12, 1976, a detailed inspection of the brake system was conducted on vehicle #1 combination. This inspection was conducted at Nyack Garage, Emigrant Gap.

Vehicle #1 combination consisted of a truck-tractor and semi-trailer. The truck-tractor was a 1970 Kenworth 3-axle with Utah State License plate #35645 serial plate A14546 serial #741933. The truck-tractor had major damage to the front end and the chassis was severely distorted causing the engine and other running gear to be shifted from normal position.

The brakes on all braked axles of vehicle #1 combination were straight air "S" cam type. #1 axle (steering axle) was not equipped with brakes. All other braked axles were equipped with type 30 brake chambers. #3 axle was also equipped with piggy back type spring brakes.

First inspection of brake system indicated no apparent damage to it from the accident.

Due to inoperation of engine from damage caused by the accident the engine was not able to be operated. Air from an air compressor at Nyack Garage was supplied to the #1 or wet tank. The pressure of 120# maximum was used. Upon application of this air the entire system was charged and no leaks were detected. Test air gauges were attached to the glad hands that would normally be connected to the trailer. Upon opening of the tractor protection valve from the cab of truck-tractor, a reading of 120# was indicated in the emergency or hot line. Upon hard application of the foot pedal, a reading was also shown on the test gauge connected in the service line. While watching each wheel brake chamber with several brake applications, I found all operated except #3 axle on left side. The push rod appeared to be out to full limit and would not move with brake application. I found the problem was caused due to the slack adjuster was backed off completely in the opposite direction than normal. This would have had to be done on purpose and not accidentally. Push rod travel was then checked on the remaining brakes with the following results:

Brake lining thickness was observed to be approximately:

	LEFT	RIGHT
#1 axle	5/8"	5/8"
#2 axle	5/8"	5/8"

Driver's Log Book

Upon inspection of current Drivers Log Book all entries indicate stops as stated by driver. Last entry was shown as off duty at 1300 hours, this is shown probably in mountain standard time which is 1 hour ahead of local time, in Reno, Nevada.

Opinion and Conclusion

Based upon examination of brake system of vehicle #1 combination:

1. Three of 4 braked wheels on truck-tractor were out of adjustment. As per 26453 V.C. Reference H.P.G. 83.2 Sec. 3.6.20-4. This indicates push rod travel for a type 30 brake chamber shall be no more than 2 inches. This is maximum stroke before brakes should be adjusted.
2. The 4th braked wheel was completely inoperative due to slack adjuster being backed completely backwards. Upon application of brake pedal the push rod would not activate the cam shaft. The brakes on this wheel would not operate.
3. A 6# air drop on application of brake pedal over a 1 minute period is a violation of 26453 V.C.
4. Three of 4 brake wheels on semi-trailer were well within brake adjustment recommendations. 4th wheel was on a borderline condition.
5. The Jacobs Engine Brake was only 66 percent effective due to 1 of 3 engine head solenoids being inoperative.
6. The air compressor after t/c appeared to be in an operating condition, no damage caused by accident.

The accident was caused by a combination of driving too fast for road conditions, other traffic and a lane closure, and in an attempt to slow down; was unable to do so due to lack of proper brake adjustment. Four or 8 braked wheels were either inoperative or out of adjustment. The fifth wheel was on the edge of needing adjustment. The lack of proper brake adjustment should have been noticed by Driver 1 as per 34500 V.C. reference Calif. Administration Code Title 13, Sec. 1218C.

	LEFT	RIGHT
#1 axle	not equipped	with brakes
#2 axle	2-1/4 inches	2-1/8 inches
#3 axle	inoperative	2-3/8

In checking air gauge on dash board against test gauge noted the following results:

Test Air Gauge	= 120#
Dash Air Gauge	= 130#
Difference	= 10# High

The following readings were noted on the test air gauge.

Low Pressure Warning Device Operated at 57#
Tractor Protection Valve Retains Air in Tractor at 30#

Brakes Released Pressure (1 minute period) 3# drop

* Brakes applied Pressure (1 minute period) 6# drop

*This drop was caused by small air leaks in top of control valve over #2 axle. This damage was old and not caused by accident.

In checking application and release of spring brakes I found Emergency Brake control valve on dash board of cab did function properly.

Brake lining on all brakes were found to have the following thickness:

LEFT	RIGHT
#2 axle approximately 1/4"	Approximately 1/8"
#3 axle approximately 1/4"	Approximately 1/4"

The truck-tractor was equipped with a jacobs engine brake. The switch controlling this was found to be in the on position. In checking the solenoids in the engine heads, with the battery from the vehicle I found 2 of the three were operating but the 3rd one, in the middle pair of cylinders, did not operate.

The shock absorber on #2 axle left side was missing. Brake chamber on #3 axle left side was loose on mounting bolts. Brake drum on #3 axle left side had a deep groove approximately 1/8" deep x 1/2" wide. This caused by wear of bolts holding brake lining to brake shoes against face of drum.

Semi-Trailer:

Air from Nyack tow truck was applied to glad hand connections at front of trailer. No air leaks were detected in air system. The following push rod travel was noted:

LEFT	RIGHT
#1 axle - 1-3/4"	1-3/4"
#2 axle - 2-1/8"	1-3/4"