Truck Shipment Example: One-Time

8. Using the same LTL shipment, find online one-time (spot) LTL rate quotes using the FedEx LTL website

$$q_{\text{frac}} = 0.2889 \text{ ton}$$

$$= 0.2889(2000) = 578 \text{ lb}$$

$$\text{no. units} = \left\lceil \frac{0.2889(2000)}{40} \right\rceil = 15 \text{ cartons}$$

- Most likely freight class:

$$s = \frac{40 \text{ lb/unit}}{9 \text{ ft}^3/\text{unit}} = 4.4444 \text{ lb/ft}^3$$

$$\Rightarrow \text{ Class 200}$$

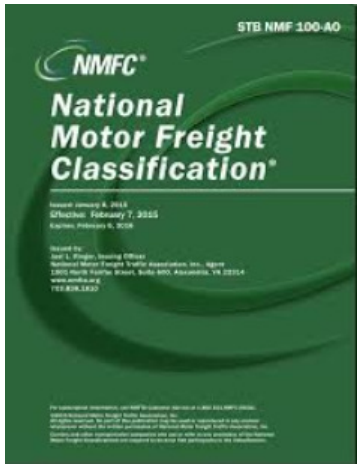
- What is the rate quote for the reverse trip from Gainesville (32606) to Raleigh (27606)?

Class-Density Relationship

Class	Load Density (lb/ft³) Minimum	Load Density (lb/ft³) Average	Max Physical Weight (tons)	Max Effective Cube (ft³)
500	–	0.52	0.72	*2,750*
400	1	1.49	2.06	*2,750*
300	2	2.49	3.43	*2,750*
250	3	3.49	4.80	*2,750*
200	4	4.49	6.17	*2,750*
175	5	5.49	7.55	*2,750*
150	6	6.49	8.92	*2,750*
125	7	7.49	10.30	*2,750*
110	8	8.49	11.67	*2,750*
100	9	9.72	13.37	*2,750*
92.5	10.5	11.22	15.43	*2,750*
85	12	12.72	17.49	*2,750*
77.5	13.5	14.22	19.55	*2,750*
70	15	18.01	24.76	*2,750*
65	22.5	25.50	*25*	1,961
60	30	32.16	*25*	1,555
55	35	39.68	*25*	1,260
50	50	56.18	*25*	890

Truck Shipment Example: One-Time

- The *National Motor Freight Classification* (NMFC) can be used to determine the product class
- Based on:
  1. Load density
  2. Special handling
  3. Stowability
  4. Liability



Item	Description	Class	NMFC	Sub
Abietic Acid	Abietic Acid, in drums	55	42605	-
Accordions	Accordions, in boxes	125	138820	-
Acetonitrile	Acetonitrile, in boxes or drums. See item 60000 for class dependent upon released value	85	42645	-
Acetylene	in steel cylinders	70	85520	-
Acid Fish Scrap	Fish Scrap, NOI, dry, not ground, pulverized nor screened, or Acid Fish Scrap, in bags	77.5	69980	-
Aircraft Parts	metal, struts, skins, panels	200	11790	01
Aluminum Channel	U channel	60	13340	-
Aluminum Table Set	aluminum table SU	200	82105	01
Ambulance Stretcher	stretcher	200	56920	06
Arches Support	Iron Steel	60	52460	-
Architectural Details	6 - 8 lbs per cubic foot	125	56290	05
Architectural Details	2 - 4 lbs per cubic ft	250	56290	03
Assembled Furniture	Bathroom cabinet set up	300	39220	01
Assembled Furniture	Highboys, dressers, wooden set up	125	80120	01
Assembled Furniture	Wood furniture 4-6 Lbs per cu ft	150	82270	04
Assembled Furniture	Chairs wooden setup w/out upholstery	300	80770	01
Assembled Furniture	Chairs wooden setup w/out upholstery KD	125	80770	03
Assembled Furniture	Couch w/ back & arms put together	175	80865	03
Assembled Furniture	Chairs put together w/ upholstery	200	79255	01
Assembled Furniture	Metal cabinets in boxes	110	39270	06
Assembled Furniture	18 gauge steel cabinet	70	39340	-
Assembled Furniture	Benches, cabinets, tables for workstations	125	23410	-
Assembled Furniture	Buffets, china cabinets put together	125	80080	-
Assembled Furniture	Cabinets of metal or plastic for storage	92.5	39235	-
Assembled Furniture	Tanning bed	150	109050	-
Assembled Furniture	Mattresses, in packages or boxes	200	79550	-
Athletic / Sporting Goods	Gym equipment, playground, sports items. Density Item			
Attachments: Backhoe	NOI: Attachments, backhoe (Backhoes), tractor or truck, on lift truck skids or pallets:	175	114217	01
Attachments: Backhoe	Attachments, backhoe (Backhoes), tractor or truck, on lift truck skids or pallets: Each shipped with all components secured to a single pallet, platform or skid, weighing 1100 pounds or more and having a density of 8 pounds or greater per cubic foot	100	114217	02

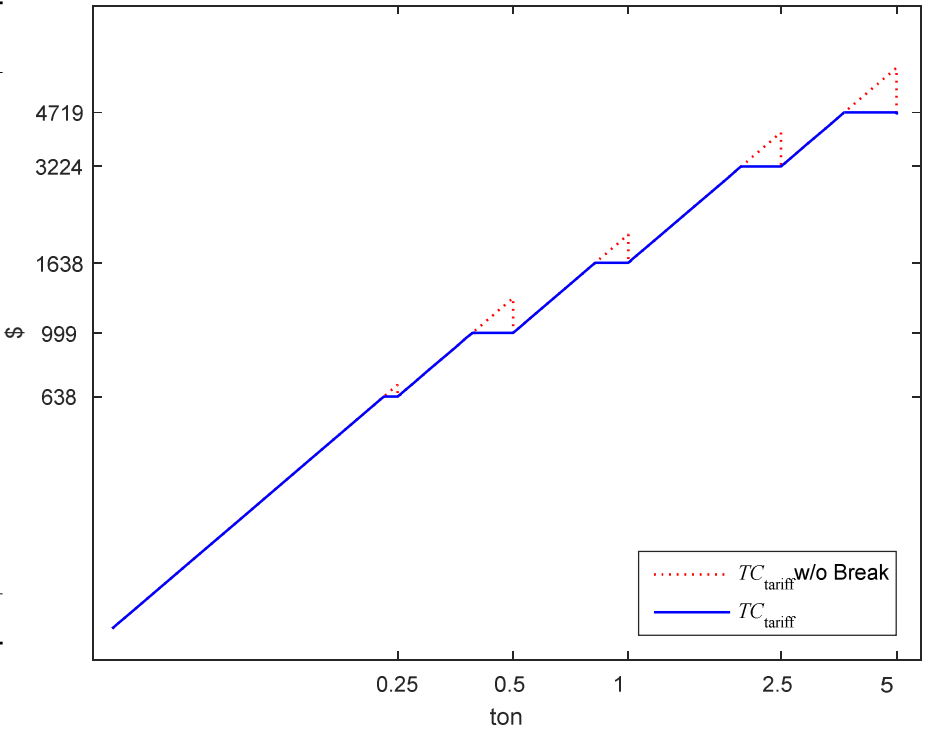
Truck Shipment Example: One-Time

- CzarLite tariff table for O-D pair 27606-32606

$$cwt = \text{hundredweight} = 100 \text{ lb} = \frac{100}{2000} = \frac{1}{20} \text{ ton}$$

Tariff (in $/cwt) from Raleigh, NC (27606) to Gainesville, FL (32606)
(532 mi, CzarLite DEMOCZ02 04-01-2000, minimum charge = $95.23)

Freight Class	Rate Breaks (i) 1	2	3	4	5	6	7	8	9&10
500	341.42	314.14	245.80	201.48	158.60	112.37	55.66	55.66	55.66
400	273.88	251.99	197.19	161.61	127.22	91.12	45.10	45.10	45.10
300	206.34	189.85	148.56	121.76	95.85	69.47	34.43	34.43	34.43
250	172.56	158.77	124.23	101.83	80.15	58.03	28.79	28.79	28.79
200	138.78	127.69	99.92	81.89	64.47	47.19	23.40	23.40	23.40
175	121.37	111.68	87.39	71.62	56.38	41.27	20.39	20.39	20.39
150	104.49	96.13	75.22	61.66	48.53	35.96	17.75	17.75	17.75
125	87.59	80.60	63.07	51.69	40.69	30.24	15.00	15.00	15.00
110	77.57	71.37	55.85	45.77	36.04	28.61	14.40	14.40	14.40
100	71.23	65.55	51.29	42.04	33.09	27.58	14.03	10.80	9.90
92	66.48	61.18	47.88	39.24	30.89	25.75	13.68	10.52	9.66
85	61.74	56.80	44.45	36.43	28.68	23.91	13.20	10.15	9.32
77	56.99	52.44	41.04	33.63	26.48	22.07	12.60	9.68	8.89
70	52.77	48.55	37.99	31.14	24.51	20.43	12.00	9.23	8.47
65	50.07	46.08	36.05	29.56	23.04	19.39	11.87	9.14	8.39
60	47.44	43.64	34.15	28.00	21.82	18.37	11.76	9.04	8.30
55	44.75	41.17	32.22	26.40	20.59	17.32	11.64	8.96	8.22
50	41.57	38.26	29.94	24.54	19.12	16.10	11.52	8.85	8.14
Tons (q_i^B)	0.25	0.5	1	2.5	5	10	15	20	∞



Truck Shipment Example: One-Time

9. Using the same LTL shipment, what is the transport cost found using the undiscounted CzarLite tariff?

$$q = 0.2889, \quad class = 200$$

$$disc = 0, \quad MC = 95.23$$

Freight Class	Rate Breaks (i) 1	2	3	4	5	6	7	8	9&10
500	341.42	314.14	245.80	201.48	158.60	112.37	55.66	55.66	55.66
400	273.88	251.99	197.19	161.61	127.22	91.12	45.10	45.10	45.10
300	206.34	189.85	148.56	121.76	95.85	69.47	34.43	34.43	34.43
250	172.56	158.77	124.23	101.83	80.15	58.03	28.79	28.79	28.79
200	138.78	127.69	99.92	81.89	64.47	47.19	23.40	23.40	23.40
175	121.37	111.68	87.39	71.62	56.38	41.27	20.39	20.39	20.39
50	41.57	38.26	29.94	24.54	19.12	16.10	11.52	8.85	8.14
Tons (q_i^B)	0.25	0.5	1	2.5	5	10	15	20	∞

$$i = \arg\left\{ q_i^B \mid q_{i-1}^B \le q < q_i^B \right\}$$

$$= \arg\left\{ q_2^B \mid q_1^B \le q < q_2^B \right\}$$

$$= \arg\left\{ q_2^B \mid 0.25 \le 0.2889 < 0.5 \right\} = 2$$

$$c_{\text{tariff}} = (1 - disc) \max\left\{ MC, \min\left\{ OD(class, i)\, 20q, OD(class, i+1)\, 20q_i^B \right\} \right\}$$

$$= (1-0) \max\left\{ 95.23, \min\left\{ OD(200, 2)\, 20(0.2889), OD(200, 3)\, 20(0.5) \right\} \right\}$$

$$= \max\left\{ 95.23, \min\left\{ (127.69)\, 20(0.2889), (99.92) 20(0.5) \right\} \right\}$$

$$= \max\left\{ 95.23, \min\left\{ 737.76, 999.20 \right\} \right\} = \$737.76$$

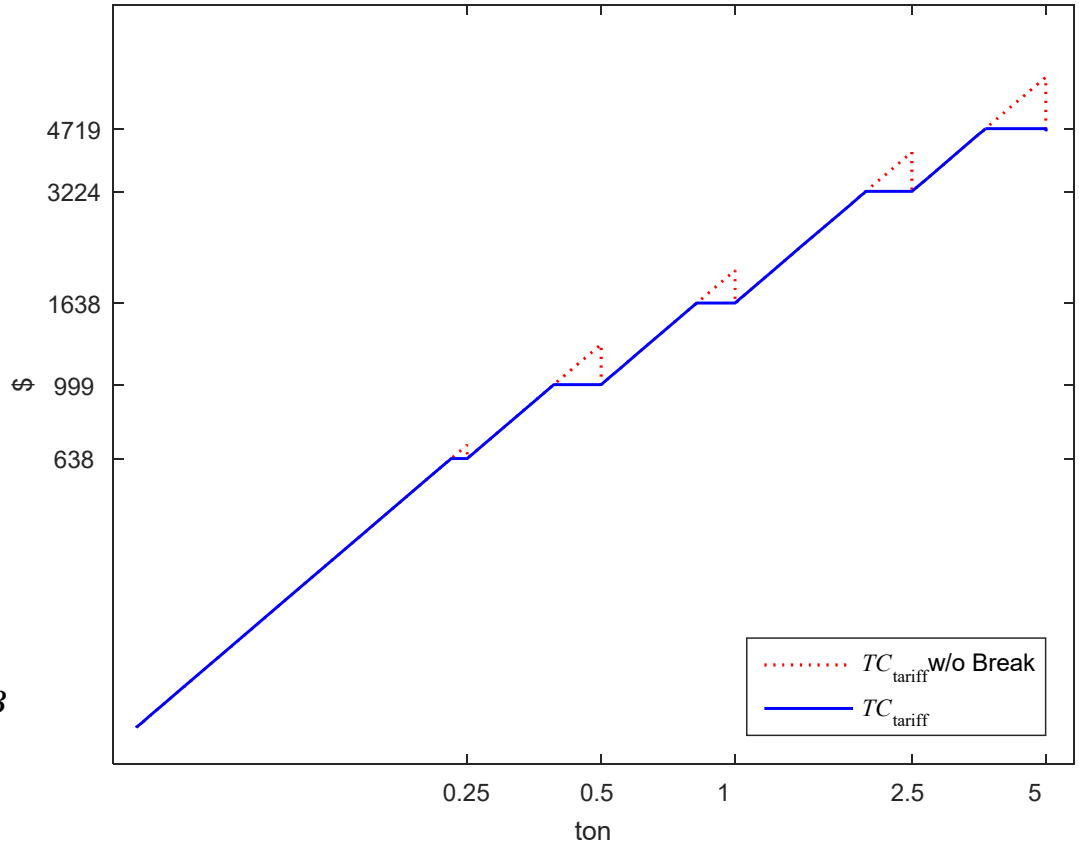
Truck Shipment Example: One-Time

10. What is the implied discount of the estimated charge from the CzarLite tariff cost?

$$disc = \frac{c_{\text{tariff}} - c_{LTL}}{c_{\text{tariff}}}$$

$$= \frac{737.76 - 584.23}{737,76}$$

$$= 20.81\%$$



- What is the weight break between the rate breaks?

$$q_i^W = \frac{OD(class, i+1)}{OD(class, i)} q_i^B$$

$$= \frac{99.92}{127.69}(0.5) = 0.3913 \text{ ton}$$

Truck Shipment Example: One-Time

- **PX: Package Express**
  - (Undiscounted) charge c_{PX} based rate tables, R, for each service (2-day ground, overnight, etc.)
  - Rate determined by on *chargeable weight*, wt_{chrg}, and *zone*
  - All PX carriers (FedEX, UPS, USPS, DHL) use *dimensional weight*, wt_{dim}
  - wt_{dim} > 150 lb is prorated per-lb rate
  - Actual weight 1–70 lb (UPS, FedEx home), 1–150 lb (FedEx commercial)
  - Carrier sets a *shipping factor*, which is min cubic volume per pound
  - Zone usually determined by O-D distance of shipment
  - Supplemental charges for home delivery, excess declared value, etc.

$$c_{PX} = R\left(wt_{\text{chrg}}, zone\right)$$

$$wt_{\text{chrg}} = \left\lceil \max\left\{wt_{\text{act}}, wt_{\text{dim}}\right\} \right\rceil \text{ (lb)}$$

$$wt_{\text{act}} = \text{actual weight (1 to 150 lb)}$$

$$wt_{\text{dim}} = \frac{l \times w \times d \text{ (in}^3\text{)}}{sf \text{ (in}^3\text{/lb)}} \text{ (lb)}$$

$$l, w, d = \text{length, width, depth (in)}$$

$$l \geq w, \quad l \times w \times d \geq \text{actual cube}$$

$$sf = \text{shipping factor (in}^3\text{/lb)}$$

$$= 12^3 / s, \text{ inverse of density}$$

$$= 139 \text{ FedEx (2019)}$$

$$\Rightarrow s = 12.43 \text{ lb/ft}^3 \text{ (Class 85)}$$

$$= 194 \text{ USPS} \Rightarrow s = 8.9 \text{ lb/ft}^3$$

Truck Shipment Example: One-Time

- (Undisc.) charge to ship a single carton via FedEx?

$$wt_{\text{act}} = 40 \text{ lb}, cu = 9 \text{ ft}^3$$

$$d = 532 \text{ mi} \Rightarrow zone = 4$$

$$\text{carton} \Rightarrow l \times w \times d = \text{actual cube} \Rightarrow$$

$$l \times w \times d = 9 \times 12^3 = 15{,}552 \text{ in}^3 = 32 \times 27 \times 18$$

$$wt_{\text{dim}} = \frac{l \times w \times d}{sf} = \frac{15{,}552}{139} = 111.9 \text{ lb}$$

$$wt_{\text{chrg}} = \left\lceil \max\left\{wt_{\text{act}}, wt_{\text{dim}}\right\} \right\rceil$$

$$= \left\lceil \max\left\{40, 111.9\right\} \right\rceil = 112 \text{ lb}$$

$$c_{PX} = R\left(wt_{\text{chrg}}, zone\right)$$

$$= R(112, 4) = \$64.27$$

FedEx Standard List Rates (eff. Jan. 7, 2019)

Service		FedEx Ground® and FedEx Home Delivery® (up to 70 lbs.)						
Delivery Commitment		1–5 days based on distance to destination						
Zones[1]		2	3	4	5	6	7	8
		0–150 miles	151–300 miles	301–600 miles	601–1,000 miles	1,001–1,400 miles	1,401–1,800 miles	1,801-plus miles
Maximum Weight in Lbs.	1 lb.	$ 7.85	$ 8.23	$ 8.96	$ 9.36	$ 9.68	$ 9.80	$ 9.96
	2 lbs.	[illegible]	9.48	10.15	10.37	10.82	11.24	11.43
	3	8.87	[illegible]	10.70	11.14	11.59	11.98	12.57
	4	9.13	[illegible]	[illegible]	11.75	12.08	12.87	13.47
	5	9.37	[illegible]	[illegible]	[illegible]	[illegible]	13.46	14.22
	6	9.68	[illegible]	[illegible]	[illegible]	[illegible]	13.81	14.48
	7	10.23	[illegible]	[illegible]	[illegible]	[illegible]	14.18	15.18
	8	10.43	[illegible]	[illegible]	[illegible]	[illegible]	14.61	15.69
	9	10.59	11.40	12.48	13.39	14.04	15.21	16.52
	10	10.84	11.51	12.60	13.76	14.33	16.10	17.62
	111	59.41	59.89	64.26	67.20	75.20	82.60	92.25
	112	60.62	61.13	64.27	67.21	75.84	83.31	92.36
	113	60.68	61.18	64.98	67.83	76.52	84.00	94.04
	114	61.32	62.45	66.33	69.15	77.81	85.41	94.65
	115	61.99	63.16	66.34	69.33	77.82	85.42	94.66
	146	82.51	84.98	88.95	89.15	98.04	105.96	118.85
	147	83.66	85.00	89.66	89.86	98.74	106.69	119.66
	148	84.68	85.63	90.61	90.62	100.20	107.40	120.46
	149	84.84	86.38	91.26	91.28	100.42	108.08	121.81
	150[2]	84.85	87.16	92.76	94.33	100.95	108.83	122.60

Note: No Zone 1 (usually < 50 mi local)