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Postal Rate and Fee Changes | Docket No. R97-1

PRESIDING OFFICER'S NOTICE OF
AREAS OF LIKELY INQUIRY AT HEARING

(February 25,1998)

On January 12, 1998, the Commission issued Notice of Inquiry No. 3 concerning changes that Postal Service witness Baron proposes to the established analysis of coverage-related load time. Responsive testimony was received from witness Baron, and from Antoinette Crowder on behalf of joint parties AMMA, DMA, MOAA, Parcel Shippers Association, and Advo, Inc. Witness Crowder provided mathematical support for the established conceptual analysis of elemental and coverage-related load time. Witness Baron and witness Crowder, however, both propose to treat various portions of STS-based accrued load time as though they were access time, on the assumption that those portions vary with the number of stops rather than with volume per stop. Both calculate a net reduction in attributable access and load time costs as a result.

Several interrogatories ask witness Baron to confirm that deducting a non-elemental portion of accrued load time per stop from the point estimates of load time predicted by the established load time variability models should cause an increase in the resulting estimates of elemental load time elasticity. See, e.g., NAA/USPS-T17-4(e); and UPS/USPS-T17-10, 14 and 15. Witness Baron confirmed that if a non-elemental amount were deducted from the point estimates from the established model, the elemental load time elasticities would increase. See, e.g., response of witness Baron to UPS/USPS-T17-10(c).

I believe that the record would be strengthened if it were to include a general mathematical description of the effects on volume variable access and load time that would result from deducting a portion of non-elemental load time from accrued average load time per stop before applying the established LTV and coverage variability models. The Attachment to this notice contains three propositions that attempt to describe these effects mathematically. Proposition 1 restates witness Crowder's mathematical description of the established load time model. Proposition 2 extends that description to the situation where a portion of non-elemental load time is deducted from accrued load time before volume variable load time is calculated. Proposition 3 extends Proposition 2 to describe the overall effect on the sum of volume variable access and load time of deducting a portion of non-elemental load time from accrued load time.

On March 2, 1998, witnesses Baron and Crowder are scheduled to be cross-examined on their testimony that responds to Notice of Inquiry No. 3. At that time they should be prepared to discuss whether the propositions described in the Attachment to this notice accurately describe these effects. They should also be prepared to discuss whether the validity of those propositions is affected if it is assumed that

1) non-elemental load time per stop is an average of different per-stop values, analogous to access time,

or

2) non-elemental load time per stop is invariant from stop to stop.

Edward J. Gleiman
Presiding Officer

Definitions

L = System load time
S = Number of stops
v = System volume for a single shape, services or collections
V = $\{v\}$ The vector of system volumes for all shapes, services and collections
P = Number of possible deliveries
g = Average load time per stop

Established Model		Crowder with P/S shown explicitly in 2.
1.	$L = gS$	From the definition of g.
2.	$g = g(V/S, P/S)$	Baron equation 1, p. 7 and equation 3, p. 8.
3.	$S = S(V)$	Baron equation 8, p. 26.
4.	$P = kS$	Possible deliveries are proportional to stops.

The function f is the expression within the brackets in Baron's equation 5, p. 17.

Elasticity Definitions (for a given shape volume)

$$E_L = \frac{dL}{dv}\,\frac{v}{L}$$

Elasticity of system load time, L, with respect to system volume, v.

$$E_V = \frac{\partial g}{\partial (v/S)}\,\frac{v}{gS}$$

Elasticity of average stop time, g, w/r volume per stop, v/S.

$$E_S = \frac{dS}{dv}\,\frac{v}{S}$$

Elasticity of the number of stops, S, w/r system volume, v.

<u>Proposition 1</u>: (Crowder) $E_L = E_V + (1 - E_V)\,E_S$.

Proof: First, note that P/S in equation 2 is independent of volume since $P/S = k$. Therefore:

$$\frac{dg}{dv} = \frac{\partial g}{\partial(v/S)}\left[\frac{1}{S} - \frac{v}{S^2}\,\frac{dS}{dv}\right]$$ differentiating g with respect to v.

$$\frac{dg}{dv} = \frac{\partial g}{\partial(v/S)}\,\frac{(1-E_S)}{S}$$ substituting E_S.

$$\frac{dg}{dv}\,\frac{v}{g} = \frac{\partial g}{\partial(v/S)}\,\frac{v}{gS}(1-E_S)$$ multiplying by v/g.

$$\frac{dg}{dv}\,\frac{v}{g} = E_V\,(1-E_S)$$ substituting E_v.

$$E_L = \frac{d(gS)}{dv}\,\frac{v}{gS}$$ substituting gS.

$$E_L = \frac{v}{gS}\left[\frac{dg}{dv}\,S + \frac{dS}{dv}\,g\right]$$ differentiating gS with respect to v.

$$E_L = \frac{dg}{dv}\,\frac{v}{g} + \frac{dS}{dv}\,\frac{v}{S}$$ collecting terms.

$$E_L = E_V(1-E_S) + E_S$$ substituting E_S and $E_V(1-E_S)$ from above.

$$E_L = E_V + (1-E_V)\,E_S$$ rearranging terms.

Comment: This result is as derived by witness Crowder. When applied to system load time, L, the expression for E_L produces several variabilities. These are:

$E_V L$ = Elemental volume variability.

$(1-E_V)\,E_S L$ = Stops coverage variability.

Stops coverage variability can be further subdivided into two distinct effects:

$E_S L$ = Direct stops coverage effect.

$-E_V E_S L$ = Stops coverage dilution effect.

The stops coverage dilution effect occurs because an increase in the number of stops, S, reduces volume per stop, v/S, which in turn reduces average load time per stop, g. There is no distinct component variability that can be attributed to possible deliveries, P, under the established model because of assumption 4, $P = kS$. In effect, possible deliveries are just a control variable similar to receptacle types and container types in equation 2.

Proposition 2: Let α be a component of average load time per stop included in g that is not volume variable and is to be deducted from L such that $L^* = (g - \alpha)S$. Then $E_L = E_V{}^* + (1 - E_V{}^*)E_S$ where $E_V{}^* = gE_V/(g - \alpha)$.

Proof: Proof of Proposition 1 is modified as follows:

$$E_L{}^* = \frac{d((g-\alpha)S)}{dv} \frac{v}{(g-\alpha)S}$$

$$E_L{}^* = \frac{v}{(g-\alpha)S}\left[\frac{dg}{dv}S + \frac{dS}{dv}(g-\alpha)\right]$$

$$E_L{}^* = \frac{g}{(g-\alpha)} \frac{dg}{dv}\frac{v}{g} + \frac{dS}{dv}\frac{v}{S}$$

$$E_L{}^* = gE_V(1 - E_S)/(g-\alpha) + E_S$$

$$E_L{}^* = E_V{}^*(1 - E_S) + E_S$$

$$E_L{}^* = E_V{}^* + (1 - E_V{}^*)E_S$$

Comment: The elasticity E_V must be adjusted if a component that does not vary directly with volume, α, is to be removed from g before the formulas of Proposition 1 are applied to determine volume variable load time. Stop coverage variability vanishes when α includes the entire component of g that is not volume variable. Proposition 2 shows that this is a property of the established model in the sense that the stops coverage variability $(1 - E_V{}^*)E_S L$ will vanish if α is chosen such that $E_V{}^* = 1$. This occurs when $\alpha = (1 - E_V)g$. For SDR stops, this implies that around 40 percent of load time per stop is not volume variable. Shifting less than that amount does not eliminate stops coverage variability.

Proposition 3: Let L and E_V be as defined for the established model and let α, L^* and E_V^* be as defined in Proposition 3, then:

1) Elemental volume variability is unchanged.
2) Stops coverage variability changes by $-E_S \alpha S$.

Proof:

$$E_V^* L^* = \frac{g}{(g-\alpha)} E_V (g-\alpha) S = E_V L$$ which proves 1).

$$E_S (1 - E_V^*) L^* = E_S \left[1 - \frac{g E_V}{(g-\alpha)} \right] (g-\alpha) S$$

$$= E_S (g-\alpha) S - E_S E_V g S$$

$$= E_S (1 - E_V) L - E_S \alpha S$$ which proves 2).

Comment: If the time deducted from load time (αS) is considered to respond indirectly to volume in the same way as access time, and $E_S \alpha S$ is added to the volume variability of access time, then the sum of volume variable load and access time is not affected by the change.