Appendix I: Derivation of the Standard Deviation of Demand Given an R-Week Review Period

$$X = \sum_{i=1}^{L+R} D_i = \sum_{i=1}^{L+R} (P_i + e_i)$$

$$V(X) = E(V(X|L)) + V(E(X|L))$$

$$= E\left(V\left(\sum_{i=1}^{L+R}(P_i + e_i)\Big|L\right)\right) + V\left(E\left(\sum_{i=1}^{L+R}(P_i + e_i)\Big|L\right)\right)$$

$$= E\left(\sum_{i=1}^{L+R} V(P_i + e_i)\right) + V\left(\sum_{i=1}^{L+R} E(P_i + e_i)\right)$$

$$= E\left(\sum_{i=1}^{L+R} \sigma_e^2\right) + V\left(\sum_{i=1}^{L+R} P_i\right)$$

$$\cong \sum_{i=1}^{E(L)+R} E(\sigma_e^2) + V(\overline{P}_{L+R}(L + R))$$

$$\cong (\mu_L + R)\sigma_e^2 + \overline{P}_{L+R}^2\sigma_L^2$$

Hence,

$$\sigma_X \cong \sqrt{(\mu_L + R)\sigma_e^2 + \overline{P}_{L+R}^2\sigma_L^2}.$$

We estimate σ_X by:

$$\hat{\sigma}_X \cong \sqrt{(\overline{L} + R)s_{DE}^2 + \overline{P}_{L+R}^2 s_{LE}^2}$$

where:

$\overline{L}$ = average lead time from supplier of this part

R = review period

s_{DE}^2 = variance of the difference between the weekly plan and the actual demand

$\overline{P}_{L+R}^2$ = average of the plan over L + R weeks

s_{LE}^2 = variance of the difference between the date requested and the date received.

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