



**Cost estimation:
Sheet metal estimating
for the HVAC contractor
and Piping/Plumbing estimating
for the mechanical contractor**

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I have been in the heating, ventilating, and air conditioning, industry (hvac) since 1950. Since I shared in the job's profit, I had a vested interest in accurate cost estimating when bidding on an air conditioning job.

If a bid is too high, you lose the job. If it is too low, you get the job and may lose money.

Most HVAC estimators estimate the cost of sheet metal duct work by the pound. There is a problem with this method: three different jobs, say a discount store, office building and a hospital, may have the same number of pounds of sheet metal duct work but will have grossly different costs.

The calculated labor must be adjusted for the complexity of the duct *and* for job conditions.

In 1975, I watched a representative for a timesharing company write a simple APL program in my office. A light went on, I thought. "Hey, I can read what he is writing. I can do that! I can speed up and improve my bidding."

I took extension courses in APL at the community college and UCLA, made a deal with STSC, and created a sheet metal estimating system which estimates labor by the operation, *not* by the pound.

The Greggway system adjusts the labor for the complexity of the duct. The estimator adjusts the labor for job conditions.

The Greggway System was on STSC's timesharing system for ten years, 1978–1988. In late 1985, a PC version was created. Contractors who were using the timesharing version in 1978 are using it today on the PC's along with over 500 contractors who have purchased the PC version.

Now, with the help of Eric Lescasse and his "Monthly APL+Win Training Program," I am working on a Windows version.

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**Financial analysis:
Boeing Capital Corporation
Financial Model**

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At Boeing Capital Corporation, we use an internally-developed pricing model to structure financial transactions. It has been in development for 15 to 20 years. It was originally written in Fortran on the mainframe and migrated to a Data General Mini Computer 15 years ago and written in APL at that time. It was ported to personal computers nine years ago using APL★Plus, APL★Plus II and is currently being converted to Windows-based programs using APL+Win.

The model is designed to analyze cash flows, taking into account the appropriate book and tax accounting methods applied and compute the after-tax economic yield on lessor's equity. It computes book and tax accounting correctly for tax-oriented leases as well as notes, discounted notes and conditional sales contracts. On the leasing side, it can analyze finance leases, operating leases and leveraged leases, both domestic and foreign. It also has the ability to analyze the cost of providing residual value and credit guarantees using probability and present-value techniques.

The model has the ability to solve problems heuristically by converging on the correct solution or mathematically solving for the best possible optimized solution. The optimized solutions are solved using the CPLEX callable library. The process for solving the optimizations is entirely managed with APL; the objective function, equations, constraints and bounds are all generated using APL. The CPLEX callable library is used to solve the algebraic matrix. The non-optimized solutions range from cost, rental or payment, residual value or balloon, early buyouts, after-tax or pre-tax lessor yield, etc. The optimization solutions are for variable or proportional rent and debt with objectives to minimize present value of rent, minimize implicit rate, maximize cost, maximize after tax lessor yield, maximize after tax cash or maximize pretax cash. The solutions have numerous constraints including leverage limits, average life of debt, minimum pretax cash flow, minimum after tax cash flow, minimum return on asset, IRS—uneven rent test, safe harbor rent test, profit test, cash flow test, and minimum equity test. The leasing model has been benchmarked against the "Best-in-Class Models" with identical results obtained with consistent assumptions.

Every transaction bought or sold at Boeing Capital is analyzed with this model. It has performed flawlessly over time and we have never failed to meet a challenge with APL.

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