

# **ELEVATE TRAFFIC ANALYSIS SOFTWARE (ELIMINATING THE GUESSWORK)**

*by Robert S. Caporale*

Having spent a good part of my career assisting architects, building owners and developers in determining the most appropriate elevator schemes for high-rise commercial and institutional buildings, I can say that one of the major efforts has been to quantify for them, in terms which can be easily understood, the parameters and criteria which represent quality elevator service. On any given project, numerous elevator traffic studies are typically performed to determine the anticipated elevator interval, average waiting time and handling capacity that a proposed elevator scheme will yield. Once calculated for a proposed lift scheme, these parameters are often discussed at great length by the design team. Often, and as a result of having had experience with numerous presentations of traffic analysis methods, the major non-elevator industry decision makers, who usually have only a general understanding of how the calculations are performed and what the calculation results mean relative to good elevator service, are confused and become skeptical of proposed solutions. Additional consultants are often called in to sort out the details, and often, meetings between numerous elevator experts result, with lengthy discussions and debates over seconds of interval and percentage points of handling capacity taking place.

Having developed an elevator traffic analysis program with George Strakosch and Bill Lewis, which we called "Eletran" to elevator all of the buildings with which we were involved over a 10-year period at Jaros, Baum & Bolles (JB&B) Engineers, I've often felt that it would be beneficial to the industry if we could have one traffic analysis program to which the industry could prescribe as being the design guide for elevator systems. While Eletran had the potential to fulfill this purpose, for many reasons, most of which had to do with the desire of major corporations during the early days of the development of computer programs to maintain proprietary software, Eletran was not distributed to other than JB&B employees. Yet, many of us in the industry felt that we should have an independent, industry-accepted traffic analysis program to serve as a benchmark against which all proposed elevator schemes could be judged. Now, such a software package has been developed and is available to fulfill this purpose.

Finally, a comprehensive elevator traffic analysis software package is available to elevator system designers and architects, which will allow them to thoroughly study potential elevator schemes to determine the most suitable elevator arrangement for providing effective passenger handling capability and quality service.

The software package – called "Elevate Traffic Analysis & Simulation" and developed by Dr. Richard Peters, formerly of Ove Arup & Partners in the U.K. and now director of his own independent engineering research and development firm – provides multi-faceted analysis and simulation software which is user friendly, Windows-driven and can be easily used to perform straightforward up-peak, enhanced up-peak, two-way traffic analysis, as well as a full simulation elevator traffic analysis of proposed building and elevator schemes. The Elevate™ software program is provided on a CD and comes with clear and concise documentation which contains a user manual section, as well as examples of the various types of analysis which can be performed. There is no limit to the number of floors or building population which can be studied, and solutions are offered in standard elevator configurations of readily available capacity and speed combinations. Studies can be performed for specific elevator arrangements by specifying elevator group, car, passenger loading and building data, and a range of solutions will be offered. In the up-peak and advanced mode of analysis performance, results are given in the usually desired group five-minute handling capacity as a percentage of the total bank population, as well as interval. Any number of solutions can be selected for comparative study to determine the preferred elevator group configuration which will provide the desired performance criteria. In the simulation mode, the software will provide average waiting times, longest waiting times, average transit times and longest transit times numerically, as well as graphically, for all of the group configurations being considered.

Elevate™'s up-peak traffic analysis was checked against Eletran, and the results were found to be precisely the same. Lacking in Eletran and now available with the Elevate™ software is a precise calculation of average waiting times. In most traffic studies, and as usually presented by traffic

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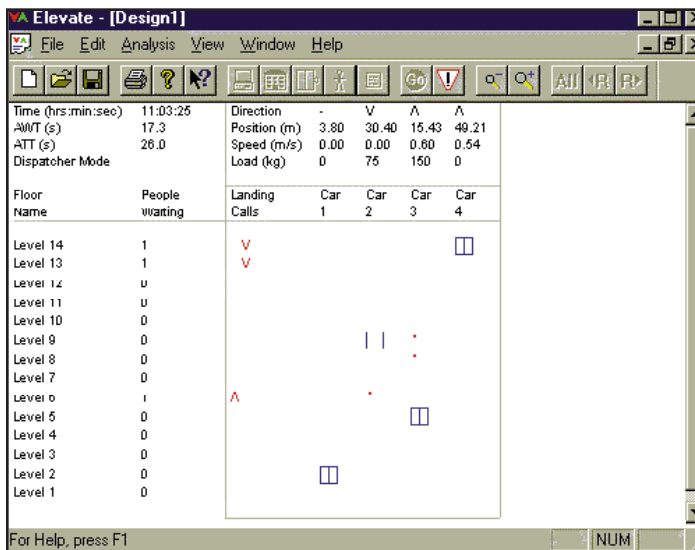
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analysis experts worldwide, average waiting times are usually presented by means of the experts' best judgment as to its relationship to the calculated interval. An example of this is seen in Dr. G. Barney's article "Up-Peak Handling Capacity Improved - What Gives?" in this issue. Conventional traffic analysis methods calculate the roundtrip time which is then divided by the number of proposed elevators in the group to determine the interval or average time between elevators leaving the main lobby. Average waiting times are then determined as a percentage of the interval and are usually presented as ranging between 60-70% of the calculated interval. This determination results from observation and field measurement of actual elevator usage in busy buildings. While this method of determining average waiting time has served as the basis for elevating many buildings for a good many years, it is really left up

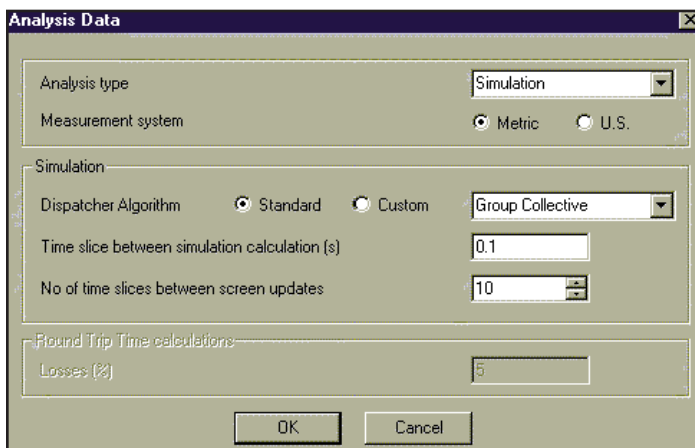
to the judgment of the system designer to substantiate the basis for recommendations in this regard. Elevate™ software now takes the guesswork out of waiting time analysis and calculation.

In performing an elevator traffic analysis, an objective method of calculation of average waiting time has really been needed. While it is important to calculate the interval, it is really the passengers' average waiting time that we are trying to determine for any elevator scheme being considered. As described earlier in this article, the calculation of interval is based on the determination of anticipated roundtrip time. It is, therefore, a matter of determining the time duration of the various elements that comprise a roundtrip and adding the sums. This is a straightforward process, whereas the determination of average waiting time is a bit more illusive. What must actually be done is

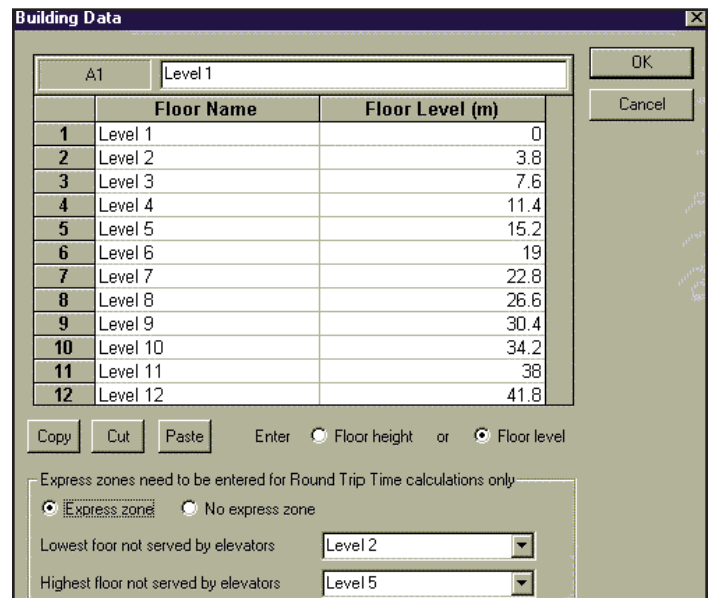
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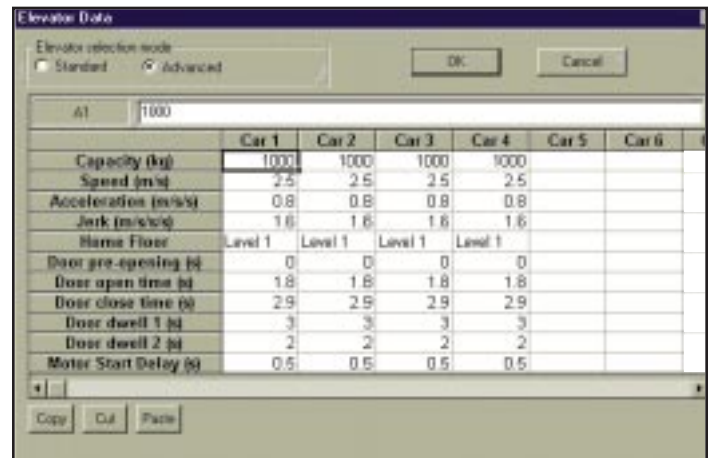
The main display area provides a graphical representation of the building. When a simulation is running, the elevators and calls placed on the system are displayed. When a Roundtrip calculation is being performed, a progress report is displayed. This is discussed in more detail in **Running the Analysis**. Once the analysis is complete, the main display area provides a preview of the data and results that can be printed. This is discussed in **Results**.



This dialog contains general information about the analysis you want to perform. The Analysis type selected here reflects what data is entered in **Building Data**, **Elevator Data** and **Passenger Data**.



The **Building Data** dialog contains information about the building.



**Advanced** mode can only be used when the **Analysis type** is **Simulation**. In **Advanced** mode, data is entered in a table. As in **Building Data**, this table operates like a Microsoft Excel spreadsheet; you can use formulae, speed fills, drag and drop, etc. to help with data entry.

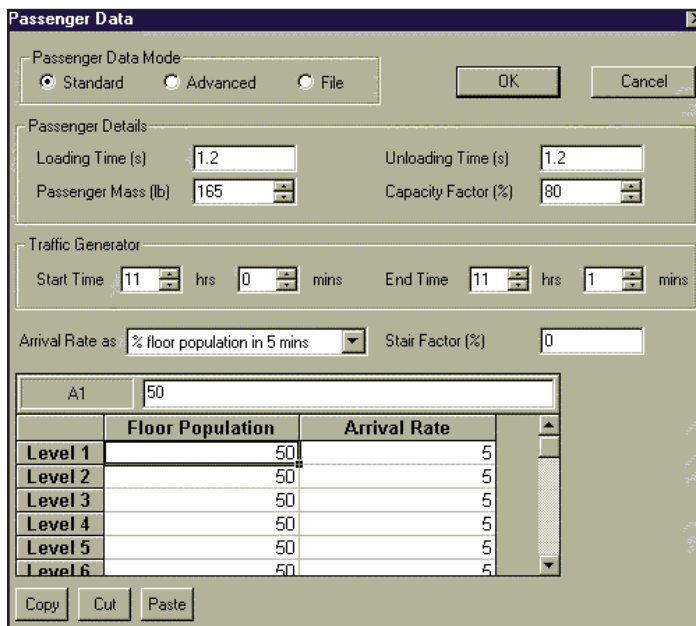
to obtain the total sum of the time passengers can be expected to wait for elevators to respond to hall calls and divide that number by the number of calls registered.

In the past, this was left to intuition and judgment. Now, however, by using Elevate™ in the simulation mode, the traffic analyzer can, by means of mathematical modeling of hall and car call activity for any desired elevator scheme and building configuration, actually calculate and display both numerically and graphically the average waiting time that proposed scheme will yield. This is a major breakthrough in elevator traffic analysis and

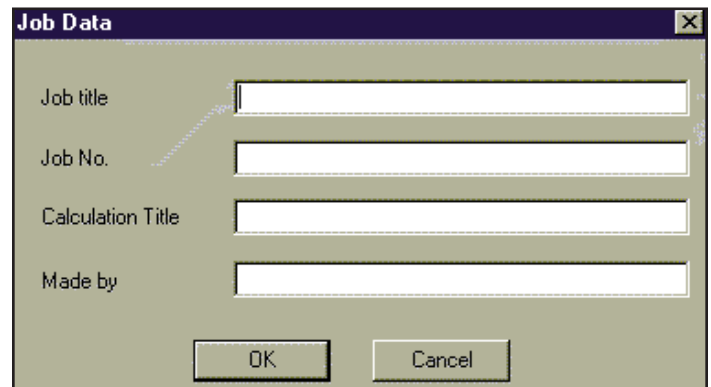
provides an objective method of study. No longer will designers, consultants and architects have to use rules of thumb or subjective methods of study to determine the most appropriate elevator scheme for a building. Using consistent inputs, either as selected by the software or as specified by the designer, the results will be the same and can be readily replicated and compared for accuracy and consistency.

An important aspect of Elevate™ is that it provides the opportunity for all of the elevator system parameters to either be selected automatically by the software or specified as inputs to the program. Door times, acceleration, jerk rate, door pre-opening times (if desired), car start time, passenger transfer times, passenger weights and car loading as a percentage of total elevator capacity can be specified by the designer, as well as selected automatically by Elevate™.

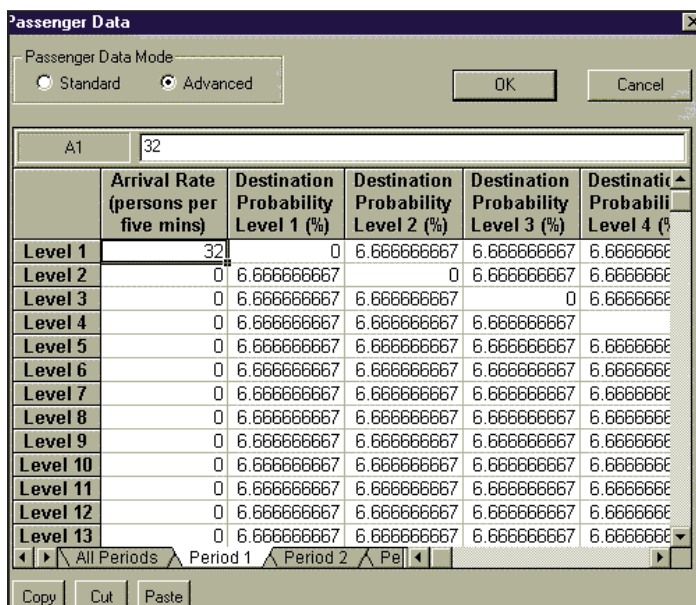
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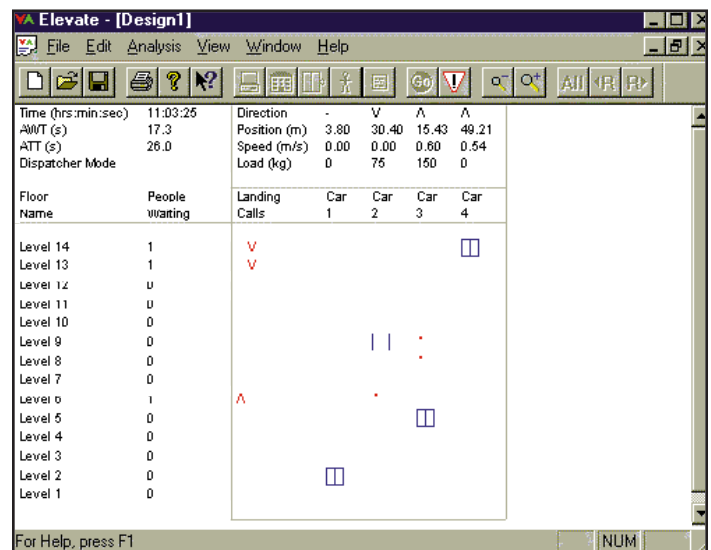
The **Passenger Data** dialog contains information about the passengers using the elevators. There are three modes in which you can enter your data.



Job data allows you to record details of the project and who has performed the calculations. This information, the date and document name is included in the header of all **Elevate™** print-outs.



For all rows completed in **All Periods**, you must complete the corresponding arrival rate and destination probability table, which can be selected by clicking on the **Period 1**, **Period 2**, etc. tabs.



When a **Simulation** is running, you are given a full visual display of the elevator's operation. The **Floor Names** are displayed, as entered in **Building Data**. The floor-to-floor heights are drawn to scale according to the **Floor Levels**, also entered in **Building Data**.

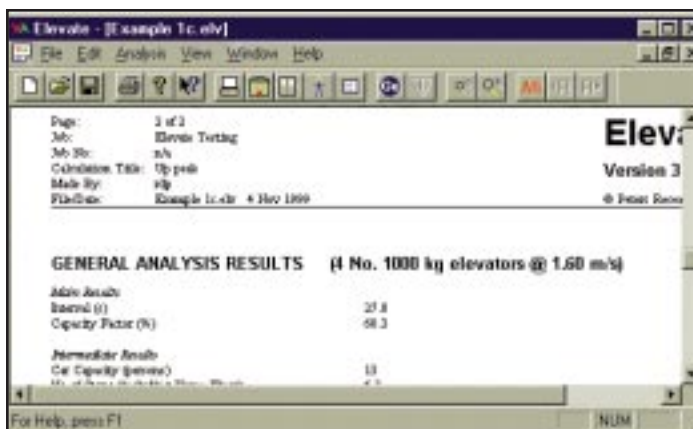
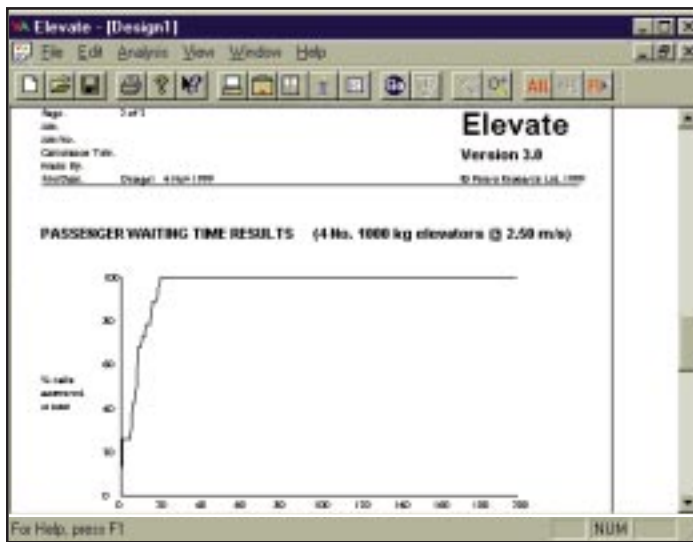


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Group configurations can be studied, as is usually done when all elevators in the group are the same capacity and speed, as well as using any number of combinations of capacity and speed for lifts in the same group. Although it is not likely that the designer will be considering any more than eight cars in a bank of lifts, groups of 12 cars can be studied.

Building populations can be evenly distributed on floors served by the elevator group under study or, as will be the case in an actual building, with more or less people on any number of levels in the building. The analysis software responds to the demand for service as dictated by the building population distribution within the lift group and calculates the group's performance accordingly. Any number of basements below the group's main entry floor - as well as restaurants, conference areas or any high-density traffic-generating floors at any location in the building - can be specified for the group under study.

The software is easy to install and requires the use of a PC with Windows 9X or Windows NT. The recommended minimum hardware specification is a Pentium 75 MHz with an 8-MB RAM processor. Analysis results



are presented in tabular, as well as graphical form, and when performing a simulation, Elevate™ displays a schematic of the building with the elevators shown moving through the elevator shafts, in response to car and landing calls which are, along with waiting passengers, clearly indicated in a readily recognizable elevator group monitoring style. This software package provides an easily understandable pictorial display of the elevator group analysis while it is underway and which can also be used to study and show perspective clients precisely how long it will take to evacuate a portion of the building by using the lifts. This is particularly useful when considering fire evacuation schemes and many other potential disaster scenarios. (See the article "Lift Management in Emergencies" by Ray Lacey in this issue for additional explanations of when such studies might be important.)

Elevate™ uses a conventional elevator group automatic dispatching algorithm which can be customized to incorporate any desired group dispatch system. Peters Research Ltd. engineers are available to provide this service to purchasers of the Elevate™ software package.

Elevate™'s elevator traffic analysis results can be saved, printed out or transferred into Excel spreadsheet documents. The program can be run and results displayed in either metric or imperial units, making this a truly international software package.

The software has been developed and is technically supported by the U.K. firm of Peters Research Ltd. of Bucks, England and is available through a retail agreement from ELEVATOR WORLD'S Educational Division. Individual copies of Elevate™ can be purchased, and for firms needing multiple copies for multiple users, group licensing is also available. An annual subscription service can be obtained which provides Elevate™ owners with updates of the software package and unlimited technical support directly from Peters Research Ltd.

Richard Peters has a degree in Electrical Engineering and is a Doctor of Engineering. He pursues a broad range of professional interests with notable expertise in software development, mathematical modeling, vertical transportation and environment engineering. His research papers have been widely published.

Peters worked for 10 years with international engineering consultants Ove Arup & Partners. In 1997, he set up his own company, Peters Research Ltd., which provides software development and engineering consultancy.

For more information or to order Elevate™, contact ELEVATOR WORLD'S Educational Division at phone: (334) 479-4514, fax: (334) 479-7043, e-mail (sales@elevator-world.com) or by visiting our Web site (www.elevator-world.com).

