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A Realistic Approach to "Interesting" Claims - Lessons in Lift Traffic Analysis -

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INTRODUCTION

Over the past 10 years as a lift consultant, I have encountered a great deal of disorder and confusion with regard to traffic analysis. Elevator suppliers make unsubstantiated claims about performance of their elevators. Clients use the terminology Interval synonymously with Average Waiting Time. Consultants run simulation studies applied to high rise residential tower under the assumption of up peak traffic. If we in the lift consulting business are honest with ourselves, we would not have to look very far to find disorder and confusion. Although it is easy to contend that the confusion is due to "those other guys, not me," it is my contention that we lift professionals should do all we can to minimize the confusion. This paper will present four related lessons that I have learned as a specialist in elevator traffic analysis. The bottom line is something that I'm sure everyone would agree with … that clarity and the attention to technical detail are of the utmost importance.

We will present four examples where disorder might occur and recommend steps to minimize the confusion. These examples involve claims of lift performance, Destination Control, simulation, and modernization studies

LESSON 1

Over the past 10 years, the freight train called Destination Control has been picking up more and more momentum. For example, an overwhelming majority of the lift modernization projects in San Francisco have upgraded from conventional two-button ETA-based dispatch to a destination based system whereby a passenger enters his/her destination floor on an input device in the hallway.

But with this popular technology there often comes a bit of disorder and confusion. For example, I know a lift consultant who would have the building owner believe that if he would control his elevators with a destination-based system … commonly referred to as DD … he could save an elevator. In other words, for example, five elevators under DD control would perform as well as six elevators under conventional control. Also, I'm sure that we have all seen PowerPoint slides from one or more elevator suppliers who say categorically that "DD will improve performance by 25%." What's the customer to believe?

An example will be presented that will illustrate how these confusing and often unsubstantiated claims might be treated. We will show how it could be possible to use traffic analysis to fairly arrive at the conclusion that one fewer lift would "work" or that the performance would improve by some staggering percentage. The case will be made that full disclosure should

be demanded. For example, if you claim to reduce the number of lifts based predominantly on Up Peak traffic, then you should also present analysis for other important traffic periods (e.g., lunch time) before forming your final recommendation. And if you claim a large improvement in performance, you should provide a precise definition of the metric that you are using for performance. Do you mean Passenger Waiting Time? Time to Destination? Hall Call Response Time? Lobby crowding?

LESSON 2

When a new office tower is in the proposal stage, it is common for the owner and his architect to spend a day interviewing several lift suppliers. Supplier X will say that "we have the best dispatch algorithm in the industry." Supplier Y will follow X's presentation with a slide that contains the following text: *We have the best dispatch algorithm in the industry.* The owner turns to his lift consultant and asks "Who really does have the best dispatch algorithm, and how do they know?"

We will present a discussion of this oft-unsubstantiated claim and what can be done to resolve the issue. One might think that we could propose a set of building and traffic conditions and ask each competitor (X and Y) to provide a traffic study in which values for important performance metrics are documented. However, we argue that this is not that easy. First, each competitor has its own software for traffic analysis which could have important differences in simulation modeling. Second, each competitor may well use slightly different values for important input parameters that would affect the results. Third, even such a fundamental concept as the definition of passenger waiting time can be different. So we contend that, for example, just because Supplier X claims an Average Passenger Waiting Time (AWT) of 18.7 seconds and Supplier Y claims 16.9 seconds … a 10% difference … we should not conclude that Supplier Y has a better dispatcher. We know that there are three very reasonable ways to determine waiting time, and there can be a substantial quantitative difference between them.

So how can we reduce the disorder and minimize the confusion? A good start would be to require each supplier to provide its analysis with the same software … e.g., Elevate … and use an identical set of input parameters. But in the end, it is entirely likely that neither Supplier X nor Supplier Y are very much interested in this solid, technical comparison. After all, if we could all agree as to who is the best, then all but one supplier has now lost the ability to claim superiority!

LESSON 3

As a consultant, I am often asked *"Why do you spend so much time and energy doing a wide range of simulations? I thought that all you needed are simple calculations for Interval and Handling Capacity."* The direct response to this question is that simulation software commonly available not only within each major lift manufacturer but also to the general public (e.g., Elevate) provides a much more realistic assessment of elevator performance than simple Interval and Handling Capacity calculations.

Until the 1960's, the traffic analysis for elevators in a new building was limited to what we now call Up Peak Calculations. Based on the general understanding at the time that the most critical time period for vertical transportation in an office building was the early morning when tenants arrived for work. An estimate was made for the time that an elevator required to make a round trip from the Lobby, delivering passengers along the way. Probability theory was used to determine the number of likely (i.e., probable) stops and the highest floor reached. It was then shown that if this Round Trip Time were, say, 120 seconds, and there would be, say, four lifts, an observer in the Lobby would see a lift departing with a load of passengers every 30 seconds. Then by inference, the all-important Average Passenger Waiting Time would be one half of the Interval, which is generally considered to be good service. This was easy. In fact, old timers will recall doing this by hand with a pencil and paper on something called the "long form." But this method had … and still has … several major shortcomings. First, the implicit assumption is that passengers would all load onto the lift at the main Lobby level. Second, the lift would return immediately to the lobby after the last passenger exited the car. Third, the method determines only an average and cannot provide information on the frequency of long waiting times. Finally and most important, the method is dispatch-logic independent; it cannot differentiate between performance of a conventional control system and performance of more up-to-date Destination Control. Furthermore, the calculations cannot adequately evaluate the elevator service during lunchtime which is now considered more difficult to handle than morning up peak.

Examples will be presented where Up Peak Calculations provide misleading information. In one case, the failure to consider multiple entry levels in an office building resulted in excessively long waits and vehement customer complaints. In another case, the surprise installation of a cafeteria on the top floor of an office building turned a well-elevatored building into a disappointment.

LESSON 4

An owner who is interested in modernizing the lifts in his office building has asked his lift consultant for a quick study to tell him how much the elevator service can be improved with a successful modernization and destination control. The consultant's traffic study showed that the Average Passenger Waiting Time can be reduced from 25 seconds to 18 seconds. After a moment's reflection, the owner recognizes some disorder and confusion. The AWT as reported by his traffic analyzer is only 15 seconds with his present conventional control system. Why is there such a major discrepancy?

It seems that the consultant has provided results based on industry standard requirements that the lifts must be able to handle a peak traffic volume of 12% or greater where all traffic is of the Entrance type. A job site survey at the building by a team from an elevator supplier quickly discovered a number of facts that may well have been overlooked in the quick study. The primary discovery was that the peak traffic volume was only 8% per 5-minutes, which is far lighter than the textbook recommendation. Another interesting finding was that fully 10% of the passengers counted during the morning up peak period were Exit passengers. In other words, not all passengers included in the count boarded the lifts in the Lobby to travel upward to their office. Far

from it. Not only were there significant numbers of passengers getting off the lifts at the lobby but also there was a smattering of interfloor traffic. Other findings include the fact that the acceleration and floor-to-floor times were slower than the standard textbook values, and the door operation times were noticeably slower as well. Thus it was discovered that the source of the confusion and disorder was that the quick study was based on textbook parameters and requirements, which differ considerably from conditions in the building. The key issue in a modernization is to answer the following customer question: *"What performance improvement can I expect in my building?"* At this stage, the performance against textbook requirements is of only casual interest.

We will present a case study for a recent modernization project of the lifts in an 18-story office building which will highlight the difference in conclusions that one might draw using textbook requirements versus data gathered from the job site. The results will be surprising.

CONCLUSION

The four lessons that are presented are examples where attention to detail is of utmost importance. It doesn't have to be a jungle out there. Attention to technical detail, the proper use of simulation, and the understanding of key assumptions underlying the methodology will minimize disorder and confusion.