

# stat teaser

## Workshop Schedule

### DOE Simplified

April 5: Detroit, MI **New Location!**  
July 12: Philadelphia, PA **New Location!**

An overview of Design of Experiments from A to Z, based on the popular book. \$195

### Experiment Design Made Easy

April 17-19: Minneapolis, MN  
June 5-7: Detroit, MI  
July 10-12: Seattle, WA

August 7-9: Minneapolis, MN  
September 11-13: Philadelphia, PA

Study the practical aspects of DOE. Learn about simple, but powerful, two-level factorial designs. \$1195

### Real-Life DOE

September 18-19: Minneapolis, MN

Analyze real data sets and learn how to deal with messy problems! *Working knowledge of factorial designs is required.* \$995

### Response Surface Methods for Process Optimization

April 24-26: San Jose, CA  
July 17-19: Minneapolis, MN

Maximize profitability by discovering optimal process settings. \$1195

### Mixture Design for Optimal Formulations

May 15-17: Minneapolis, MN  
August 21-23: Minneapolis, MN

Learn high-powered statistical tools aimed at finding the ideal recipe for your mixture. \$1195

### Robust Design: DOE Tools for Reducing Variation

June 5-7: Philadelphia, PA **New Location!**

Use DOE to create products and processes that are robust to varying conditions. This class is a must for six sigma. *Factorial and RSM proficiency are required.* \$1195

See [www.statease.com](http://www.statease.com) for more information. Attendance limited to 20. Reserve your place by calling Sherry at 800.801.7191 x18.



ABOUT STAT-EASE SOFTWARE, TRAINING, AND CONSULTING FOR DOE  
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## Mad Mark & the Meter Gnomes

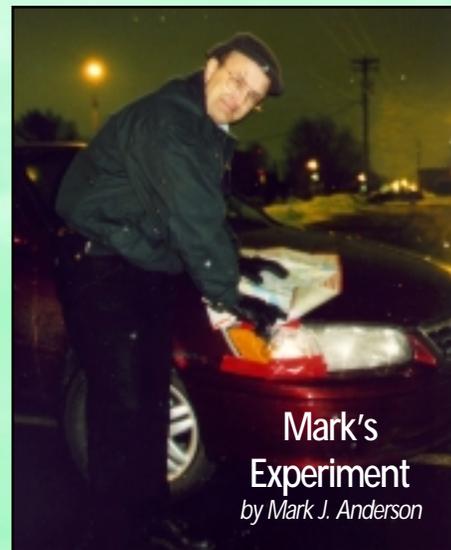
*(Preface to readers: the opinions expressed below are solely those of the author, who may be slightly off-kilter. See the sidebar for links to more factual information.)*

How do you feel when you get stuck in traffic? If you're like me, you get very frustrated at first, then you begin to take it as a personal challenge: Let's figure out a way to beat the jam-ups. As those of you who've followed this column may recall, I've been experimenting for years to find the ideal passage from home to work. Unfortunately, I've been only slightly more successful than the Europeans of old, who wasted centuries and untold lives seeking the mythical Northwest passage to the Orient. Oh, I've had some fun along the way. For example, I have fond memories of my very first driving DOE, which specified that I do combinations of two factors:

- A. Time I arrived at work:
  - On time, + Late
- B. Time I left work:
  - On time, + Early.

It was fun while it lasted. If only I'd replicated the design a few more times! I still resent the fact that, despite proving statistically beyond all doubt that coming late (A+) and leaving early (B+) would save me time on the road, my partners Pat and Tryg would not accept these results.

My second driving DOE, reported in the December 1995 Stat-Teaser<sup>1</sup>, focused on the route I took to work



Mark's  
Experiment  
by Mark J. Anderson

from my home in Stillwater, about 20 miles due east of our office in Minneapolis.

The easiest way into town is via Minnesota Highway 36, which starts just outside my neighborhood and ends only a short distance from the Stat-Ease office. However, after systematically exploring several alternatives, I found that I could save 1 minute each way by making a detour on Interstate Highway 694, thus bypassing a series of lights on 36. On an annual basis, this gave me the equivalent of a whole day's vacation (1 minute/trip x 2 trips/day x 5 days/week x 50 work weeks/year = 500 minutes or about 8 hours altogether).

But then the Department of Transportation (DOT) engineers did something really diabolical; they put

--Continued on page 3.

## Rave Reviews for DX6 - Update now to 6.0.3

Design-Expert 6 (DX6) has been warmly welcomed and enthusiastically endorsed by users and reviewers alike.

One of DX6's most popular new features is its general factorial design capability. Experimenters can set up a design with factors that have up to 20 categorical levels. For instance, you may want to investigate three raw material suppliers. This can't be done with a standard two-level design, but it is easy with a general factorial design.

Other popular new features include combined mixture/process designs, tools for generating and graphing propagation of error (to help you achieve six sigma objectives for reducing variation), annotated ANOVA reports and an expanded Help system.

Stat-Ease made an excellent product even better by adding new modeling features to version 6.0.3, (available to current DX6 users for free download at [www.stateease.com](http://www.stateease.com) (click on **Software, Downloads**). With version 6.0.3 users can now generate response surface models ranging from 6th order for 4 factors to quartic for 7 factors. Mixture Scheffe models go to quartic for up to 8 components. In all cases, the total number of model terms is limited to 400. Note: The listed models only go up to cubic order. The higher-order capability must be chosen via Edit, Preferences, Design.

Check out the Stat-Ease web site at [www.stateease.com](http://www.stateease.com) for a complete list of all that is new in DX6. If you currently own version 5, upgrade to version 6 for just \$295. A new copy of DX6 is \$995. To order, use the form on page 4 or call 800.801.7191, (612.378.9449).

*"Among the design of experiments software existing in the market, DX6 is the most user friendly and comprehensive in terms of scope and the depth of coverage in design, analysis (modeling) and optimization. This is a must have tool if you are involved with process optimization and improvement."*

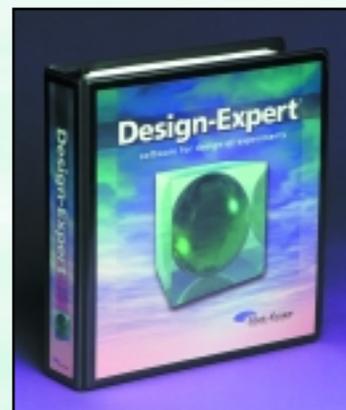
- Shin Ta Liu, Lynx Systems, San Diego  
(*Quality Progress*, p.120, December 2000)

*"The built-in help function is much more detailed and pervasive; a lot of thought has gone into this, evoking a relaxed "just folks" style.*

*Presentation of the program's facilities is now much more intuitive. The whole process is delightfully well-managed.*

*An all-pervasive approach to graphic methods yields dividends in productivity. Test runs revealed no weaknesses and consistently produced results with less effort. The outcomes proved unbreakable under cross-testing. If you've already invested in DX5..., don't hesitate: the upgrade is all gain and no pain. If you're looking for [new DOE software], download an evaluation copy and put it through its paces."*

- Felix Grant, Lecturer and Consultant in the U.K. (*Quality Digest*, p.52, October 2000 - the complete review is available, see #52, page 4.)



### Where can you find us?

**April 17** — Reliability Consortium, Minneapolis, MN

Talk by Mark Anderson: *Robust Design*

**April 25** — Quality Expo, Rosemount, IL

Talk by Pat Whitcomb & Mark Anderson (Presenter): *Making the Most from Low-Resolution Fractional Factorials (How to Save Runs, Yet Reveal Breakthrough Interactions, by Doing a Semifoldover on Medium Resolution Screening Designs)*

**May 3** — Focus Conference 2001, Troy, MI

Talk by Mark Anderson: *Design Experiments that combine Mixture Components with Categorical and/or Process Factors*

**May 7-9** — 55th Annual Quality Congress, Charlotte, NC, Booth #723

Talk: *Semifoldovers (same as Quality Expo)*

**May 20-23** — IIE 2001 Solutions Conference, Dallas, TX

Talk by Shari Kraber: *DOE Finds Vital Factors in Complex Processes*

**June 26** — Forest Products Society 55th Annual Meeting, Baltimore, MD

Talk by Pat Whitcomb and John Guerin (Presenter):

*Design of Experiments Applied to Laminating Hardwoods*

## Case Study Reprints Available

Two new case studies illustrating the use of designed experiments in industry are now available as reprints free of charge (see the order form on page 4).

**#53: "Energy Project Relies on DOE"** reprinted from *Quality*, October 2000. The National Renewable Energy Laboratory (NREL) relied on DOE software to plan a 3-year study to find the most cost-effective materials for solar air heaters.

**#55: "Designing Experiments that Combine Mixture Components with Process Factors"** by Mark Anderson and Pat Whitcomb, reprinted from *PCI (Paint & Coatings Industry)*. An easy-to-read primer on the latest trend in mixture designs - adding process variables to your experiment.

Do you have a success story you would like to share? If so, contact Heidi Hansel at Stat-Ease ([heidi@stateease.com](mailto:heidi@stateease.com)).

--Continued from page 1.

meters on just about every freeway ramp in the Twin Cities of Minneapolis and St. Paul. One of these meters stopped me dead in my tracks just when I snuck back onto 36 after doing my detour on 694. As you can imagine, this made me very angry, but not for long, because now I could do my third driving DOE!

This DOE, reported in the February 1996 Stat-Teaser<sup>2</sup>, revolved around the timing of my arrival at the ramp meter. I found that the number of cars backed up at this point followed a rising, but cyclical pattern that required a cubic polynomial model. In other words, the traffic goes in waves, rather than monotonic functions. Thus if you time it just right, you can save time. However, in the end this proved too difficult and unreliable, so I gave up and went back to the ho-hum option of going straight in on 36, taking my chances on the traffic lights.

Then a miracle occurred - a state senator (Dick Day) took up the battle flag against ramp meters. The mavens at the DOT then did the unthinkable: They decided to experiment on the meters! I'm certain that the engineers proposed doing this on a small scale, but my guess is that the boss at the DOT, being politically astute like most managers, decided that it would be best to turn all of the ramp meters off, all at the same time.

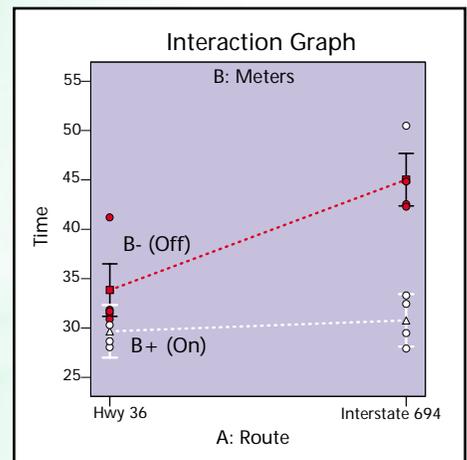
Mr. State Senator, and all of the rest of

us, rapidly developed a queasy feeling that we should've been more careful about what we wished for, because we really got it good. Not only was this ramp meter experiment suspiciously drastic, but the timing was suspect - late October through December, traditionally the very worst time of the year for traffic. It seems like Minnesotans are completely surprised when every year about this time the skies shower slippery skid stuff (AKA snow) all over the roads. They careen right and left into ditches, bridge abutments and each other, snarling traffic all over the Twin Cities. To make matters worse, December 2000 rated #2 on the list of coldest and snowiest months since the weather bureau began keeping records in the late 1800's. As you might imagine, the interaction of this bad weather with the complete shut down of ramp meters created havoc on the roads. This caused a great deal of consternation on my part, until I realized this was a golden opportunity to do another driving DOE (#4). The factors of this just-completed DOE were:

- A. Route:
  - 36 (straight-in), + 694 (bypass)
- B. Ramp meters:
  - Off, + On.

I replicated each combination four times, with routes randomized - a very desirable aspect of good experimentation in this case, where each day brings different road conditions. Unfortunately, much as I would like to control the ramp meters, this remained in the hands of the gnomes at the DOT,

who switched them back on after creating a sufficient amount of pain for all of us commuters. Therefore, no one can really be sure about the true cause for the obvious reduction in traffic after meters came back on in late December. Maybe it was all a matter of timing on a seasonal scale. In any case, as shown in the figure below, my own analysis shows a significant decrease in driving time with meters on, particularly on Interstate 694.



As you can see the effect of meters (factor B) interacts with the route (factor A). The Highway 36 route wasn't affected nearly so much when the DOT turned off the ramp meters. In fact, as shown by the overlapping least-significant-difference (LSD) bars, the meter effect on 36 was not significant at the 95% confidence level. Given this data, I've decided to stick with the Highway 36 route. It's not nearly as exciting as racing around on 694, but it's more robust to the vagaries of traffic and the meter manipulators at the DOT.

- Mark@StatEase.com

## Related Links

1,2 For the real facts of the matters discussed above, please go to the Stat-Ease, Inc. web site at [www.stateease.com](http://www.stateease.com) and click on Publications. You'll find links to Mark's previous driving studies, the data for driving DOE #4, as well as links to: the Minnesota DOT, Freedom to Drive MN (for a position paper by Senator Dick Day), and general information on ramp metering.

PS. I used the inverse transformation when analyzing my drive-time data. This transformation often improves the residual diagnostics (normal plot, etc.) of responses that really should be treated as a rate. In this case, it's a matter of thinking in terms of average miles per hour going to work, rather than the absolute time.

# Survey (Win Free Software or Book!) & Order Form

03/01

Please take a few moments to answer this brief survey. Fax it back to us at 1.612.378.2152 by May 1st. We'll enter your name in a drawing to win a FREE Design-Expert 6 software package or the book, *DOE Simplified*.

1. How do you prefer getting this newsletter (Stat-Teaser)? \_\_\_\_\_Printed by Mail \_\_\_\_\_Via E-mail (Please note address in #3)
2. Where do you get e-mail? \_\_\_\_\_No Address \_\_\_\_\_Home \_\_\_\_\_Work
3. Would you like to be alerted to frequently asked questions (FAQ's) about DOE? **Yes** **No** Please note your e-mail address here: \_\_\_\_\_

4. At your **work desk**, how do you access the Web? \_\_\_\_\_Can't \_\_\_\_\_Modem \_\_\_\_\_High-Speed (T1, DSL, etc.)

5. Comments? \_\_\_\_\_

Qty	Software, Book and Case Study Order Form - Fax to 612.378.2152	Unit Cost	Ext. Cost
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	Upgrade to DX6 from DX5 Old Serial # required: _____	\$295.00	
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