

Using DOE to Spend Less Time in Traffic: Part One

My friends and family accuse me of letting statistics drive my life. In fact it's literally true, and I'm not ashamed to say it. I recently used two statistical experiments to minimize my drive to work.

DOE #1. Determine which route goes the fastest

DOE #2. Find the optimum departure time.

This report provides details on phase 1 of the study - the choice of route. I hope this will prompt you to check out alternatives for your commute. By doing so, you will gain knowledge on DOE and save time every day you go to work.

Here in Minnesota we joke that there's two seasons: Winter and Road Construction.



Whichever season, it's a real challenge to drive in this state. I live in Stillwater, about twenty miles due east of the Stat-Ease office. Minnesota Highway 36 takes me straight in, but through a gauntlet of stop lights in North St. Paul. For several years I bypassed this stretch by taking a sidetrack on Interstate Highways 694 and 35E. However, the state's traffic engineers, who always seem to get one jump ahead of me, put a metering light on the ramp back to 36. This raised the question - which route now would be the least aggravating.

To find out I did a one-way DOE. I included two additional routes much farther north and south, but on freeways with no lights. DESIGN-EASE software produced a randomized test plan with four repeats on each of the four routes for a total of 16 runs. I left home precisely at 6:20 a.m. and timed the drive in to work. Then I fed the results in to the program. The analysis of variance (ANOVA) showed significant differences overall (>99.99% confidence), so I did a pairwise comparison. Here's the results from the post-ANOVA analysis by DESIGN-EASE showing time in minutes:

TREATMENT MEANS (ADJUSTED, IF NECESSARY)

ESTIMATED MEAN STANDARD ERROR


1. 694/35W (North)	31.5750	0.4141
2. 694/35E/36 (Bypass)	26.5000	0.4141
3. 36 (Straight in)	26.6500	0.4141
4. 94 (South)	33.2667	0.4781

Treatment	MEAN DIFFERENCE	DF	STANDARD ERROR	t FOR H0 COEFFICIENT=0	PROB > t
1 vs 2	5.08	1	0.586	8.666	< 0.0001
1 vs 3	4.93	1	0.586	8.410	< 0.0001
1 vs 4	-1.69	1	0.633	-2.675	0.0216
2 vs 3	-0.15	1	0.586	-0.256	0.8026
2 vs 4	-6.77	1	0.633	-10.698	< 0.0001
3 vs 4	-6.62	1	0.633	-10.461	< 0.0001

The results show that routes 1 and 4, which were literally long-shots to begin with, should not even be considered as reasonable alternatives (>99.99% confidence that either 1 or 2 exceed either 2 or 3). But what about the choice of driving straight in (Route 3) or taking the bypass (Route 2)? The “Prob > |t|” for this comparison is near one (0.8026), so it’s very likely that the observed difference in time occurred due to chance. I could continue to vary the two routes in a random way and eventually find the difference, but why bother.

With the knowledge gained by this DOE, I am sticking to the two core routes. I base my choice on other factors, not on the basis of expecting any difference in time. For example, if weather conditions make driving difficult, a too-frequent event in Winter, I take the straight-in route and suffer through the stop lights. Otherwise I zoom around the bypass and then rant and rave at the engineers who trapped me with the metering light on the on-ramp back to Highway 36. I only hope that their reasons for doing this were statistically and economically valid.

To be continued.

A handwritten signature in black ink that reads "Mark J. Anderson". The signature is written in a cursive style with a large, prominent initial "M".