Preliminary NTS Data Analysis

Overview

Introduction

A preliminary investigation of some data around NTS performance has been started. This document reviews the results to date.

In this paper

Following is a list of topics in this paper:

The Problem

Introduction

We all have this feeling, perhaps, that NTS is not as healthy as it could be. It would be good to do something about it, but what. How can we get our hands around a fairly difficult, and somewhat "soft" problem?

My background involves a fairly rigorous project methodology which addresses this sort of problem. In this view, the first thing you do is identify what is wrong, called the "defect". You develop a way to measure the defect so you can tell if you are making progress. You look for evidence that the defect is, in fact, fixable. You then try to identify things you can change which will affect the defect.

This is actually a pretty scientific view of what are often soft problems. The defect is viewed as the independent variable - the "Y". The things that can be influenced, or the "Key Process Variables", are the independent variables, or the "X's".

More details on this process can be found in Appendix A.

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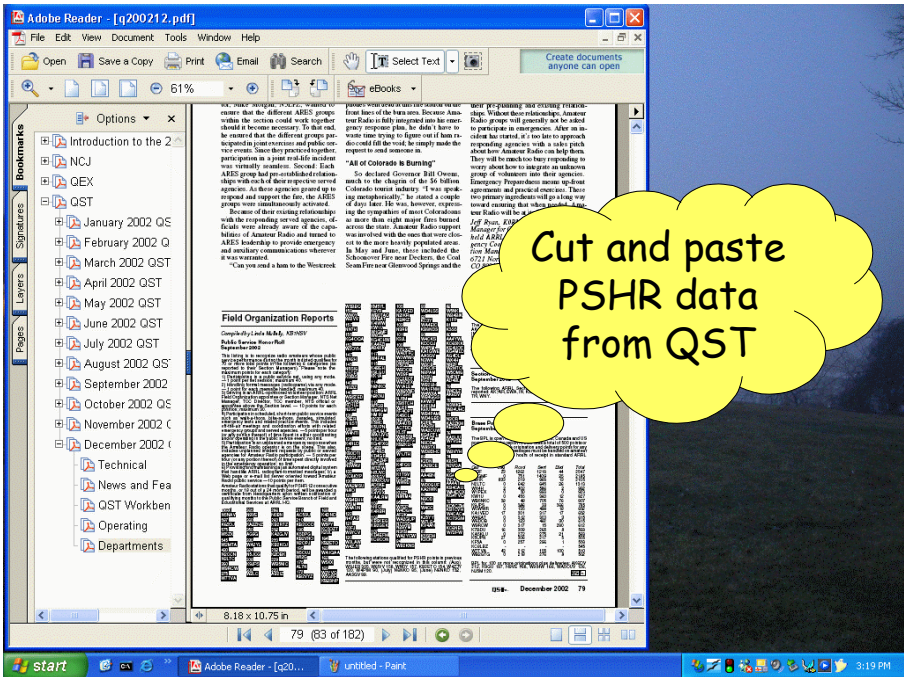
The Problem, Continued

The Data

Underlying this approach is an almost religious dogma - "follow the data". Of course, to follow the data, we need to have some data.

We have asked the League for some of their data, but while waiting for that, we realized that we have access to some data from QST. In particular, PSHR scores are reported monthly, so job one became grabbing what we have from QST.



OK, so this was a pretty tedious exercise, and besides cutting and pasting did involve some programming to organize the data, but we got at least some data to wade through.

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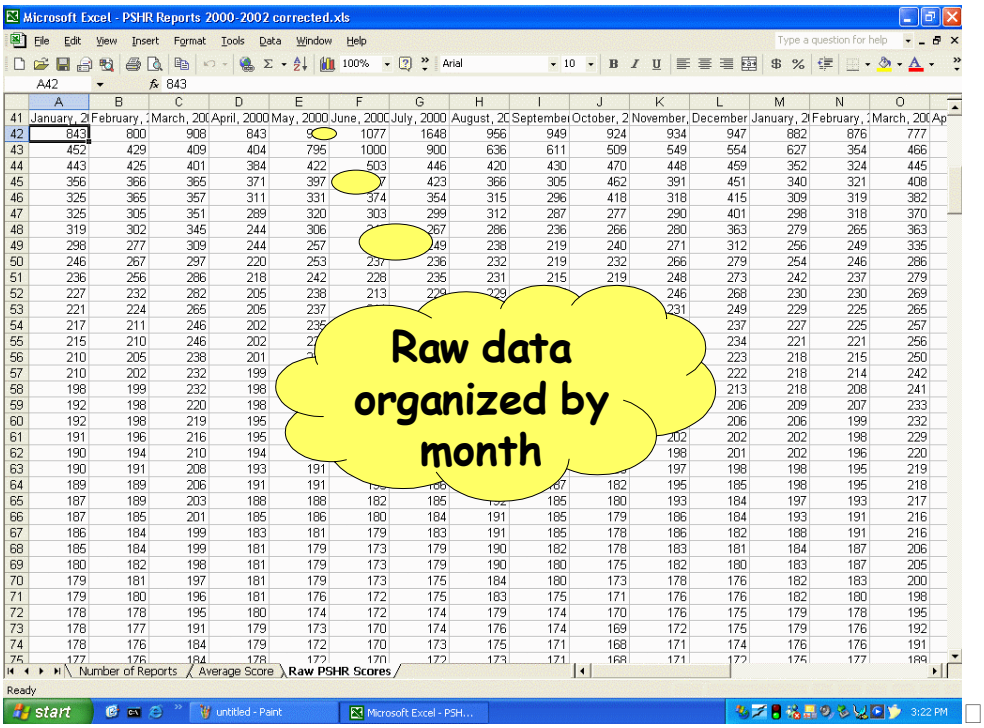
The Problem, Continued

The Data (continued)

Once into Excel, the data looked something like this:



Each individual score was organized by month. A total of 10,452 PSHR scores were gathered from QST issues covering the years 2000 through 2002.

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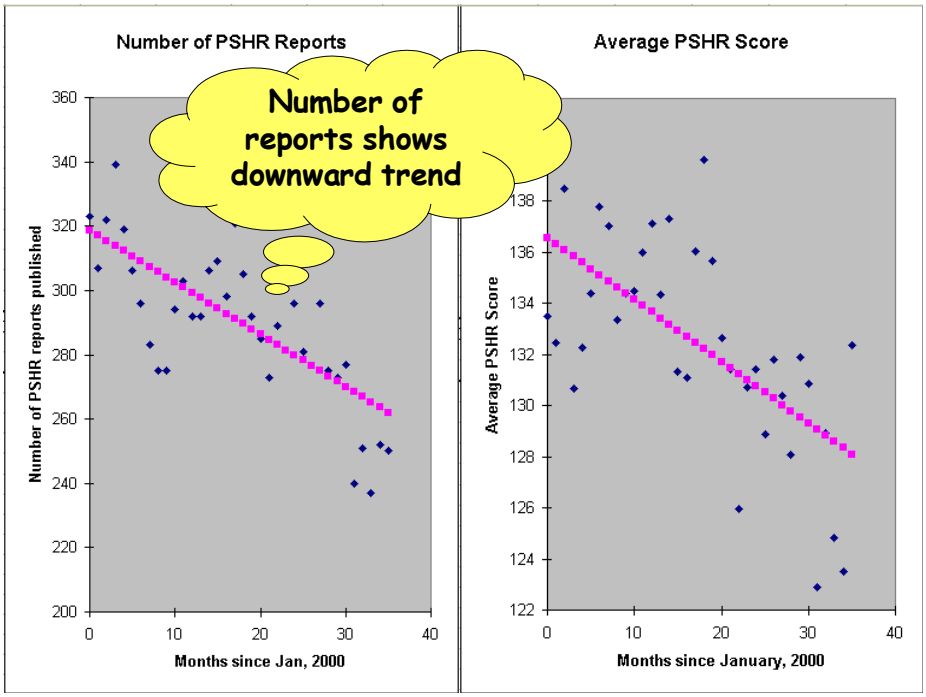
The Problem, Continued

Is there a defect

One obvious thing to look at is to see if there is some sort of a trend.



If we perform a regression analysis (the pink line on the left), we see that each month, on average, two fewer reports are published than the month before. We can also see that the average score of those reports filed also shows a downward trend.

For details of this analysis see Appendix B.

Can anything be done?

Introduction

OK. Even with our limited data, we now have some actual evidence that something is wrong, although perhaps we haven't really nailed the defect. The next issue to address is to see if there is some evidence that something can be changed.

Clues from the trends

In the trends above, there seems to be some cyclicality, especially to the number of reports. Although we need to do further analysis to prove that this effect is real, that is an indication that, if we could somehow reduce those cycles, we may be able to change them on the upside.

Also, the average scores show quite a bit of scatter. While this isn't proof that something can be done, it does indicate that higher average scores are possible, because sometimes they happen.

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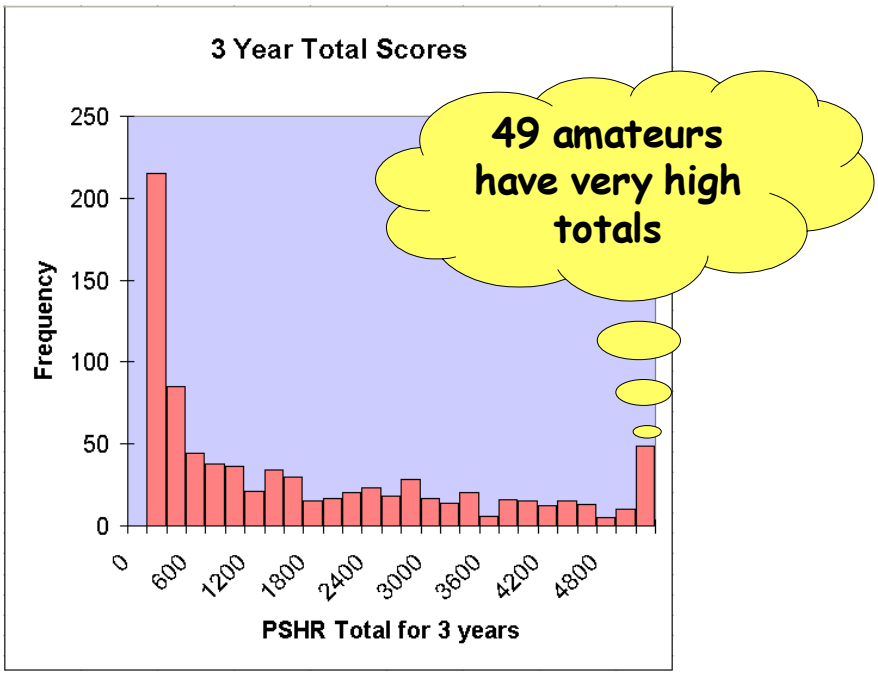
Can anything be done?, Continued

Clues from the distribution

Another interesting view is to see how the total scores for the 3 years analyzed compare from individual to individual:



There are a couple of interesting things happening here. First, not all the scores are at the low end. Personally, I would have expected a lot more skew to the left. In fact, many amateurs report far more than the minimum PSHR every month. In addition, 49 amateurs have consistently high scores. This is also pretty interesting.

Are there possible solutions?

Introduction

Having identified the fact that we have a problem, and proven to ourselves that it is at least theoretically possible to do something about it, how can we find solutions? The obvious reaction is some sort of brainstorming, which is certainly one way that should be pursued. However, brainstormed proposals should be tested against the data before taking any action to avoid failures that "seemed to be a good idea at the time".

Another approach, though, is to look for clues in the data. Again, even with our limited data, there are some interesting things going on.

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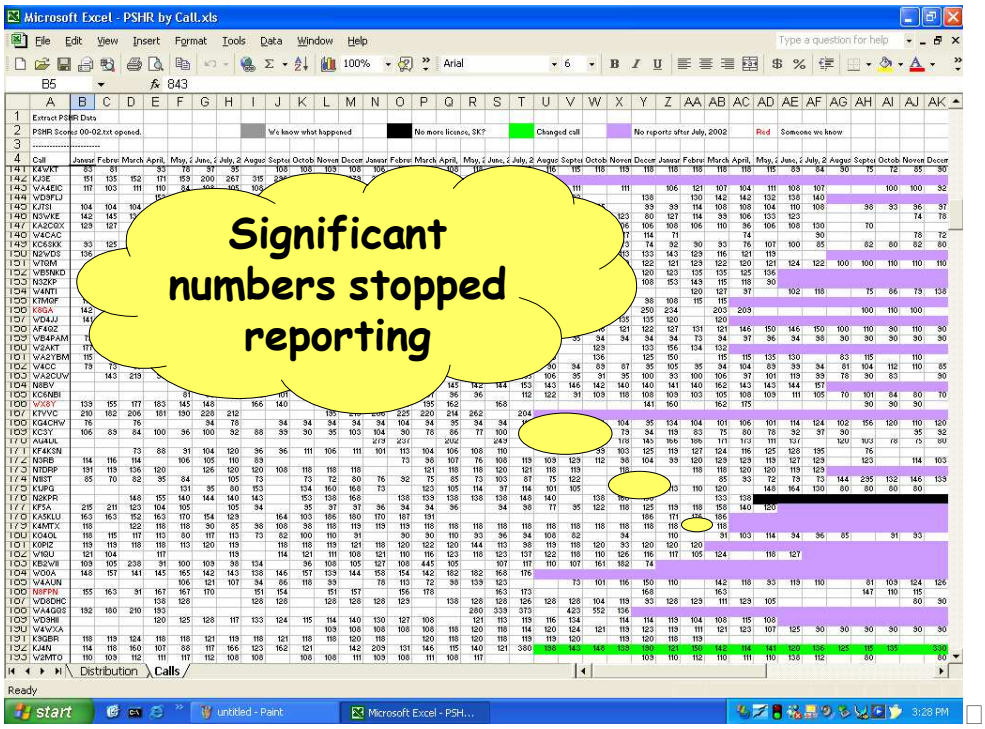
Are there possible solutions?, Continued

Hints from the distribution

On the graph on the previous page, we mentioned that 49 amateurs had very high scores over 3 years. Interviewing those amateurs may give us some insight into why they are unusually successful. In this day of the Internet, asking that question might not be as difficult as it would have been in an earlier time.

Hints from the raw data

Besides the monthly data, the PSHR scores across months were organized by call so we could get a look at each amateur's activities across time:



In this data, there are 816 calls represented. The actual number of amateurs reporting is slightly smaller because some folks obtained vanity calls during the period. Some of these could be identified through QRZ, as well as some amateurs who became silent keys during the period.

One thing that leaps out is that significant numbers of amateurs who were regularly reporting very high scores suddenly stopped reporting. Now, it could be they simply got tired of the reporting and are still very active, but we have no evidence of that. These amateurs may well have some insights into what we are doing wrong.

Local Data

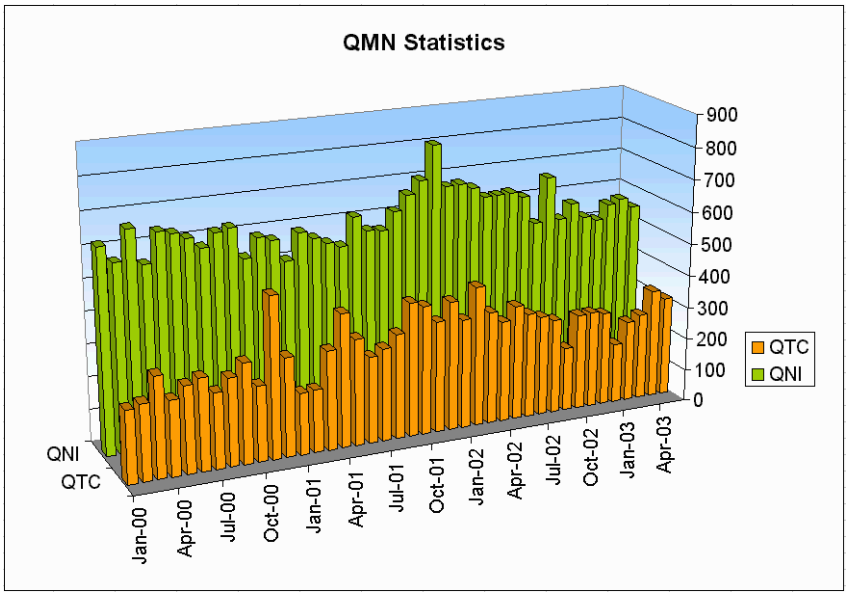
Introduction

A little closer to home, data is available from at least some local nets. Unfortunately, QST no longer carries the Section News, but net data was a little sketchy when is was being carried.

QMN, however, posts its net reports monthly to the QMN web site, so data is available from 2000 through May of 2003.

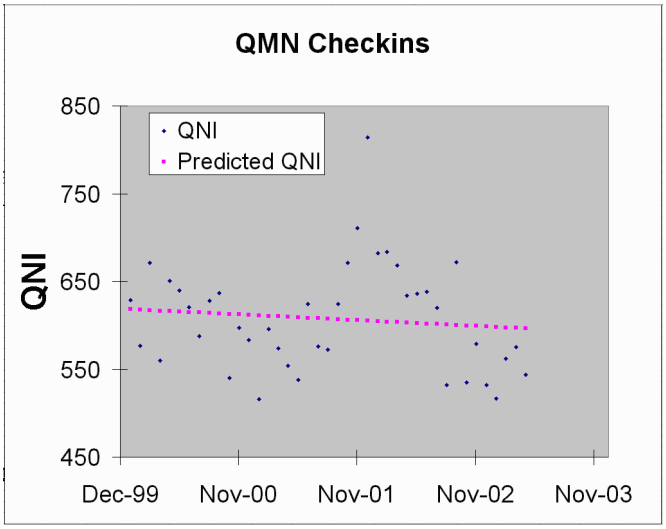
Overall QMN Data

Looking at the QNI and QTC data for just over 3 years, we see no obvious trends:



QNI Regression

While the regression line for checkins over time seems to show a slight decline, the slope is quite shallow, and the data are quite scattered. This indicates that not a lot of credence can be given to the slope of the line:



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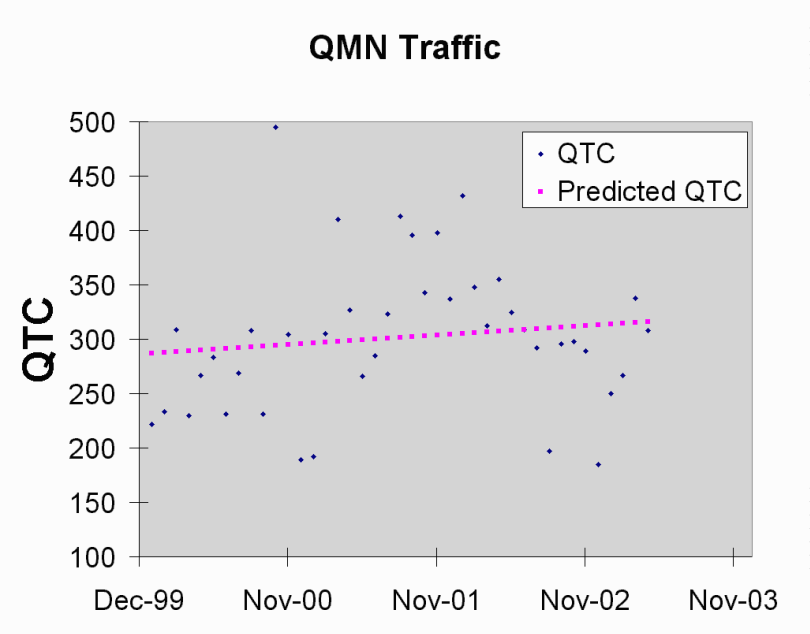
Local Data, Continued

QTC Regression

Performing a regression on the QMN traffic also gives a poor fit, although not quite as poor as for checkins (R value of 0.13 vs. 0.10). However, this time the slope is decidedly not negative:



This R value of 0.13, while actually quite a bit better than the 0.1, still doesn't give us a lot of confidence that there is (or isn't) a change in the amount of traffic we are seeing. But we can derive some comfort from the fact that the data doesn't give us any evidence that the traffic is decreasing.

Next Steps

Introduction	Now that we understand we have a fixable problem, besides waiting for additional data from the ARRL, what are the next steps?
Identify the defect	Although we have some evidence of a defect, we still don't have an agreed upon target to go after. We probably need to wait until we see additional data, but before we can proceed with confidence, we need to clearly articulate a defect, and set a target for improvement.
Additional Analysis	As we mentioned earlier, there seems to be some sort of cyclicality in the number of PSHRs published. We need to do some additional analysis of that data in order to validate that what we seem to see is, in fact, the case. There are mathematical tools available to help with that.
Interviews	We see several places where we need to go talk to people. We know of a number of amateurs who regularly report high activity. What makes them different? What motivates them? Is there something we can do to make more amateurs act like them? There are also a number who have ceased reporting. We also should talk to them. It is likely that they have some insight into why people stop being active, and again, with a clear understanding of what the causes are, we can look to fixes.
Brainstorming	Two heads are better than one, and more heads are better yet. After we have a clear picture of what is going on, and a clear target of where we would like to be, we should assemble a group of amateurs to brainstorm a number of solutions.

Conclusions

Conclusion	At this point, we have some data that indicates that we have a problem, and that it may be possible to correct the problem. It appears we have a number of resources identified who may be able to give us some insight into what is causing the problem. It seems apparent that the opportunity is before us to make a real improvement in NTS, and it would be irresponsible to fail to pursue it.

Appendix A - The MAIC Process

Introduction

The methodology being followed here is called MAIC, which stands for the four steps in the process: **M**easure, **A**nalyze, **I**mprove, and **C**ontrol. To engineers, this seems like common sense, but it is becoming a very popular approach in industry, not only for manufacturing processes, but for transactional processes, like NTS.

For each of the phases, the methodology provides a very rich set of tools. Some of the tools are statistical in nature; you need statistics to be confident that what you think you see is real. But a lot of the tools are tools to help the imagination, to help understand where people's behavior is an issue, and to clarify what might go wrong.

Measure

In the first step, data is collected to identify the defect and establish a baseline value. Data is also gathered to determine whether there is any evidence that it is possible to achieve a significant shift in the process. The typical target for a MAIC project is a defect reduction of 70%. A defect doesn't have to be a broken widget; defects could be undelivered messages, insufficient operators, or an inability to recruit enough net controls.

Analyze

In Analyze, potential input variables are evaluated. Often models are developed to see if changing an input variable can lead to the expected change in the output variable. The outcome of Analyze is a degree of confidence that changing an input variable can lead to the desired defect reduction, and that it is realistic to change the input variable.

Improve

In Improve, potential solutions are developed and tested, often through pilots. When confidence is gained that a particular solution can achieve the desired result, it is rolled out across the organization.

Control

In control, measures are put in place to monitor the result, and mechanisms are developed to prevent backsliding to the way things were before the change was implemented.

Appendix B - Regression Details

Introduction

Regression analysis is a technique used to determine the best fit line through a set of data. Basically, a form of the equation is assumed, and the best value for the coefficients is calculated. In this case, we assumed that the equation was a straight line.

It is important to note that just because an equation fits the data doesn't mean that the implications of the equation are true. Nevertheless, the regression results can provide clues as to what may be going on.

Number of Reports

The derived equation for the number of reports is:

```
Y = 318.7 – 1.62 * X
```

Where Y is the number of PSHR reports published in QST and X is the number of months since January, 2000.

The regression R value was 0.7 which indicates a fairly good fit.

Average Score

The derived equation for the average score is:

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Y = 136.5 - 0.24 * X
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Where Y is the average PSHR score reported in QST and X is the number of months since January, 2000.

The regression R value was .63 which indicates a fair fit.

What is this "R"

There are a number of values calculated to help evaluate how good a regression actually is. The R value is one of the simplest to refer to because it has a meaning that can be explained in terms other than mathematical. Basically, R squared represents the fraction of the variation that is "explained" by the equation. So in the Number of Reports regression, the R value of 0.7 means that just about half of the variation is "explained" by the equation.

The word "explained" needs to be taken with a grain of salt, however. The regression makes **no statement** about causality. Just because there is a good fit doesn't mean that the independent variable(s) cause the dependent.

There is also no magic R value that means we have a fit. In industry, investments would often be made based on an R value of 0.7, providing the implications didn't conflict with common sense. In medicine, on the other hand, R values as low as 0.l might be pursued, because finding solutions to difficult diseases often have an air of grasping at straws. In industry, that same 0.1 would be taken as essentially "no relationship".

In the case of the QMN Traffic regression, the 0.13 gives us no confidence that QMN traffic is increasing, indeed we can't say with confidence that it isn't decreasing, even with the positive slope.