

**By using computers to aid in the design and detailing of temporary traffic management control plans, Andrew Sturrock I.ENG. AMICE, FIHE argues that there now is a case for bespoke site-specific design in EVERY situation.**

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There may be a few readers of this article who will not understand the significance of what I am saying in the above headline, indeed there will be some readers who do not even relate to the words “temporary traffic management control plans” which put simply means the signing and guarding of Contra-flows, Work zones, Road Works, Traffic Accommodation, Diversions Detours, Lane Closures, Mobile Works, Emergencies, Planned Works or whatever you call them in your part of the world.

The basic objective of a temporary traffic management control plan is to permit the contractor to work within the public right of way safely, efficiently and effectively while maintaining a safe, uniform flow of traffic; however a control plan has many other uses as we shall see later on.

The collective term “temporary traffic management” is something of a Cinderella subject for traffic engineers. Yes, there are a whole host of national standards available that offer guidance along with legal, contractual and safety obligations, but it can be left to the people on site to decide what is needed, can't it? Well yes, in certain cases it can - but how does the scheme originator ensure that the people on site know what is needed for a particular work site?

Many national highway authorities produce typical signing/delineation drawings that illustrate various types of roadwork sites **[see diagram 1]**; these drawings are invariably in a schematic format. Some examples of countries that adopt this practice are:

USA - MUTCD Part 6H,  
New Zealand- Code of Practice for Temporary Traffic Management  
UK - Traffic Signs Manual Chapter 8  
Eire -Traffic Signs Manual Chapter 8 (NOT the same document as the UK version)

These typical layouts usually range from signing for works on or adjacent to the shoulder, through differing types of lane closures and mobile works up to complicated contra-flow arrangements on multi-lane highways.

Given the infinite variety of situations that can be encountered at any specific work site it would be impossible for the national standards to even attempt to cover all scenarios, the best they can do is to show the required/desirable minimum standards leaving whoever is responsible to apply the standards indicated on the typical layouts to the prevailing conditions found on a particular site, making adjustments and amendments where necessary. But this then begs the question as to whether a secondary bespoke drawing (temporary traffic management control plan) is created using the national standard as a guide (a mandatory requirement in some countries) or the national standard is implemented directly on site. Anyone with experience of the latter task will know that it is not as straightforward as it may first seem and it is one of the reasons I am making the case for bespoke site specific design in EVERY situation.

I concede that in some instances it may be appropriate just simply to specify the relevant national standard layout or occasionally it may be sufficient to require that the principles of a standard layout be applied to a particular site, for example at a junction, but then how do you know that the end-user has a up-to-date copy of the relevant standard or access to the national specification for

temporary traffic management? Answer is you don't, and of course in most other circumstances it is always desirable to produce a bespoke detailed design.

Consider this: Many types of civil engineering projects carried out on public highways (from simple maintenance tasks to large scale improvement schemes) will require the inclusion of engineering drawings in the overall scheme documentation. It is all very fundamental really, the engineering drawings are required for estimating, planning and construction purposes and without them it would be very difficult to cost, procure and implement the project and of course impossible to check the finished results, never mind ensure that ongoing quality and standards are being maintained. I would argue that in addition to engineering drawings the overall scheme documentation should include detailed bespoke temporary traffic management designs or at the very least specify the temporary traffic management to be utilised at a particular work site. Here are some of the reasons why:

It's a rare work site that has a full copy of the national specification for temporary traffic management available for the workforce to study as an alternative.

If the works are to be tendered, it shows prospective contractors what has been agreed at the design/planning stage with third parties (Police, local highway authority, client, frontage owners, public transport operators, etc).

Reduces liability by showing that the scheme designer has considered traffic management and not simply left it to the contractor to prove that the proposed works are practicable and may be carried out safely. In many countries it is a mandatory requirement to produce this level of detail, typically as part of a traffic control plan.

Creating the design well in advance of the start of works on site allows considered decisions to be made rather than rushed or perhaps commercially influenced ones

Gives work site staff access to detailed drawings that can be worked to/checked against on site.

There are a number of easy to use and affordable software programs available that have been specifically developed to aid in the design and detailing of temporary traffic management control plans

If the above reasons are not sufficiently compelling, consider the fact that in the USA alone, over 1000 people are killed every year at roadwork zones. The safety of the public and the workforce is not a matter to be dealt with lightly; it should never be thought of as "just a few signs and cones".

So how can we be certain that both the public and the workforce are adequately separated from each other? Is it reasonable (or in some countries legal) to leave the vital safety work of signing and delineating a work site to the knowledge of site personnel with, as far as the scheme originator may know, unknown abilities? I would argue not

One of the main requirements of temporary traffic management drawings is clarity. In this respect, schematic drawings are ideal. The drawings need to clearly show the equipment (signs, cones, etc.), required in each of the various sections of a work site.

### **[See diagram 2]**

These are usually taken as being:

**The advance warning area** – the approach to the site where appropriate traffic signs are installed, advising motorists of the type of traffic management on the road ahead and what actions they should take to safely negotiate the site, for example, "left lane closed" and "reduced speed limit"

**The transition area** – the location at which traffic is diverted from its normal path, typically a taper where one or more lanes are closed to traffic by means of cones, drums, barricades or other means

of delineation.

**The buffer area** – often optional but highly recommended nonetheless, an area for inattentive motorists who ignore all the advance signing and the transition to safely come to a stop in before they crash into...

**The work area**, self explanatory, followed by...

**The end of works area** – typically 'road works end' signing and perhaps some type of regulatory signing to indicate to motorists that they have passed the site and may resume normal driving.

Wherever you find yourself in the world, there are a limited number of permissible types of signing arrays that may be erected in the advance warning area. Either the left or right lanes will be closed or narrowed and there may be some form of positive traffic control, whether by means of site personnel with STOP/GO (or STOP/SLOW) signs or traffic signals. There could be some type of restriction placed on traffic as it passes through the site, typically a reduced speed limit but overtaking, weight, width or height restrictions may also be encountered. Equally, there are a limited number of options as to how the other parts of a worksite can be delineated, with traffic passing through the site in varying numbers of lanes, perhaps using a paved shoulder if one is available.

To a motorist approaching or passing through, a work site can often look very complicated, but as shown in diagram 2 the basic principles are very simple, especially if you consider each part of the diagram as a single building block, and that each of these "building blocks" can be placed together to form the basis of a site specific layout. **[See diagram 3]**. Given access to a photo copier and a pair of scissors then fairly detailed layouts can be achieved quite quickly using the old "cut and paste" methods.

However, what can be achieved by hand in most cases can be achieved many times faster using a computer and will include extra benefits. Modern computer aided design (CAD) software lends itself to producing the various combinations required to create site specific layout drawings and includes a whole host of added benefits.

The reasons for using CAD are the same as using word processing: It saves time and money by taking care of the mundane tasks so your creativity can be used elsewhere. Diagrams created using a CAD systems are of better quality, are more accurate, and consistent. Rapid changes can be made to existing layouts, its easy to mirror and copy, great for "handing" the layout, modifications such as changing variable text are easy tasks to perform, I could go on and on listing the benefits of CAD but I am also making the case for bespoke site specific temporary traffic design in EVERY situation and simply going out and buying a CAD system and obtaining or downloading a bucket load of typical drawings from the internet will not in itself help.

A key advantage of CAD as opposed to manual methods is the ease of creating multiple copies of entire drawings. Imagine a mile long urban road with number of tee and cross junctions, you can create an initial temporary traffic plan at the start, add in details for the first set of junctions, now copy and move the whole lot along the road, make minor adjustment as necessary and repeat over and over again and before you know it you have just created a whole set of plans for the entire road in a fraction of the time it would have taken you to create one by manual methods.

As I previously mentioned, typical drawings available from the Internet or other sources will not necessarily help you; these "drawings" **[See diagram 1]** could be in incompatible file formats (PDF, DDW, CD, DGN and TIF typically for use with Adobe, AutoCAD, COREDRAW or MICROSTATION). Now the worlds most popular CAD system is AutoCAD and maybe you or your employer have made wise decisions and you have access to a full or LT based AutoCAD system, you are still not home and dry. **Diagram 3** is our target drawing and a key aspect to the rapid creation of similar traffic control plans is the "building block" with "minor adjustment" approach, so the individual parts (the building blocks) must be compatible with each other, have correct scale and have common reference points in order that they can be joined together and they must be able

to be easily modified. Simply having access to these “intelligent blocks” is also not enough you will also need an easy to use interface, a good management system and a set of “special” tools help you along.

Back in 1992 I was designing UK motorway contra-flows; at that time, I did not have access to a computer aided design (CAD) system but from previous experience, I knew that CAD was ideally suited to producing the type of schematic drawings that I was tasked with producing. Further, when I looked around and saw the occasionally questionable standard of roadwork signing, I realised that there could be a market for user-friendly temporary traffic management software that was compliant with Chapter 8 of the UK Traffic Signs Manual. This software would enable operational highways staff to produce site-specific control plans. No longer would there be any need for temporary signing to be left to the tender mercies of whoever happened to be on site at any given moment. I bought a computer, some AutoCAD software and a printer and set to work. Some 600+ man-hours later the initial version was complete and contained several hundred traffic signs, carriageway layouts and sections of typical traffic management layouts for roads up to dual three lane motorways. I used the services of a local AutoCAD development company to build in the user interface, create the user manuals and market the software – CONE was born

Now ten years on and there hundreds of users of CONE throughout the UK benefiting from the quality and productivity the package affords them, but I have never been one to rest on their laurels and about eighteen months ago the local AutoCAD development company and I decided to develop a new version of CONE that not only brought the package into line with the latest UK standards but also raised the usability and quality levels another notch. Dual colour and classic styles are now available on every one of the thousands of individual signs and layouts that make up CONE. We also decided to “future-proof” the package by introducing attributes and storing data in a way that is not only just used by the new scheduling routine but could also be utilised later on in 3D visualisation, animation or virtual reality extensions.

However, we haven't stopped there. One evening, whilst surfing the Internet, I came across the US Federal Highway Authorities website and quickly found the Manual of Uniform Traffic Control Devices (MUTCD), the US equivalent of the UK Traffic Sign Manual. It didn't take me long to establish that there didn't seem to be a US CAD equivalent of CONE, so it seemed logical to produce a US version. The power of the Internet being what it is, one thing rapidly led to another and there are now versions of CONE available for the USA, New Zealand and Eire. Also in the pipeline are versions for Canada and Australia. All are based on AutoDesk's popular AutoCAD product, either LT or the full version. Each version is based on the principles shown in each countries national standard for roadwork signing. In the case of Canada, there not being a strict national standard as such, the various provincial standards have been used, so organisations working in more than one province will be getting a real bargain – I estimate the final Canadian version will have in excess of 5000 AutoCAD files. The other versions tend to have around 1200 to 4000 separate files, representing thousands of hours of AutoCAD work.

So CONE is now available in four international flavours with at least two more nearing completion. Each of the versions work in the same manner, have similar easy to use interfaces and management tools, they have similar affordable prices and they are integrated into AutoCAD and AutoCAD LT and, of course, have the benefits of industry standard dwg file format. In fact CONE is fast becoming the de-facto international standard for the production of temporary traffic management control plans.

In summary, the implementation of protection measures for both the public and the workforce on public highways are not matters to be considered lightly. Well thought out and sufficiently detailed drawings, showing where and how signing and delineation measures are to be installed are a vital part of this protection. Modern CAD methods offer a cost effective, high standard method of achieving this requirement.

There is no need or excuse for poorly planned and executed roadworks.

More information about CONE is available from the website at [www.conesoftware.com](http://www.conesoftware.com).

DIAGRAMS

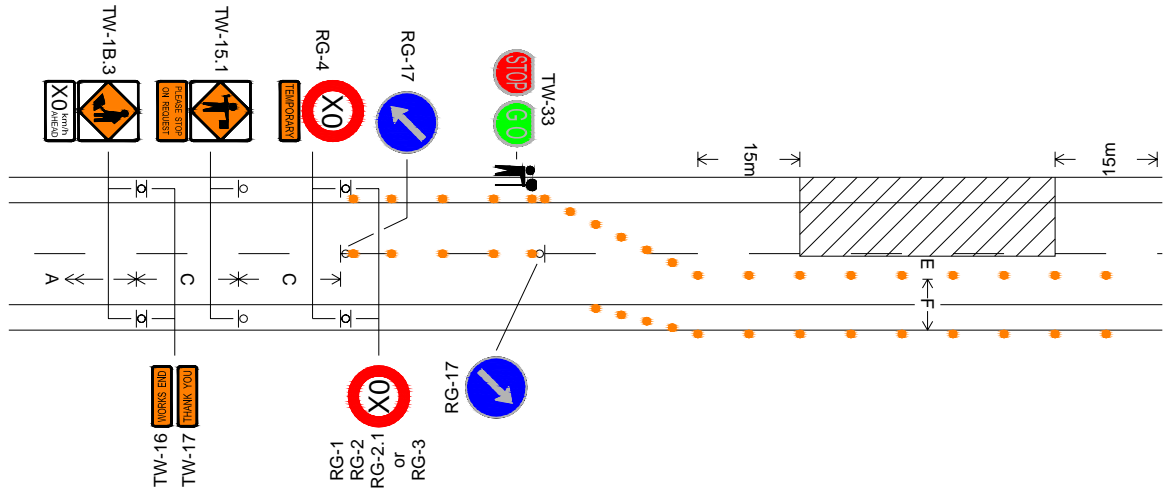


DIAGRAM 1  
 Typical national standard signing/delineation plan.  
 Has to be interpreted to suit the actual site conditions  
 Need to cross-reference to other documents

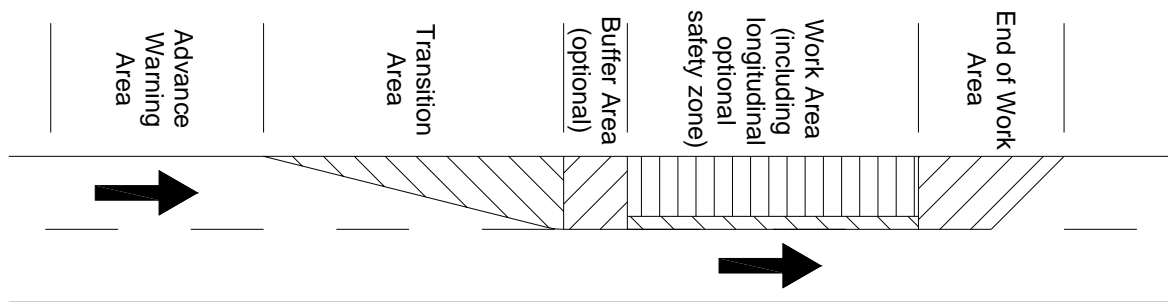
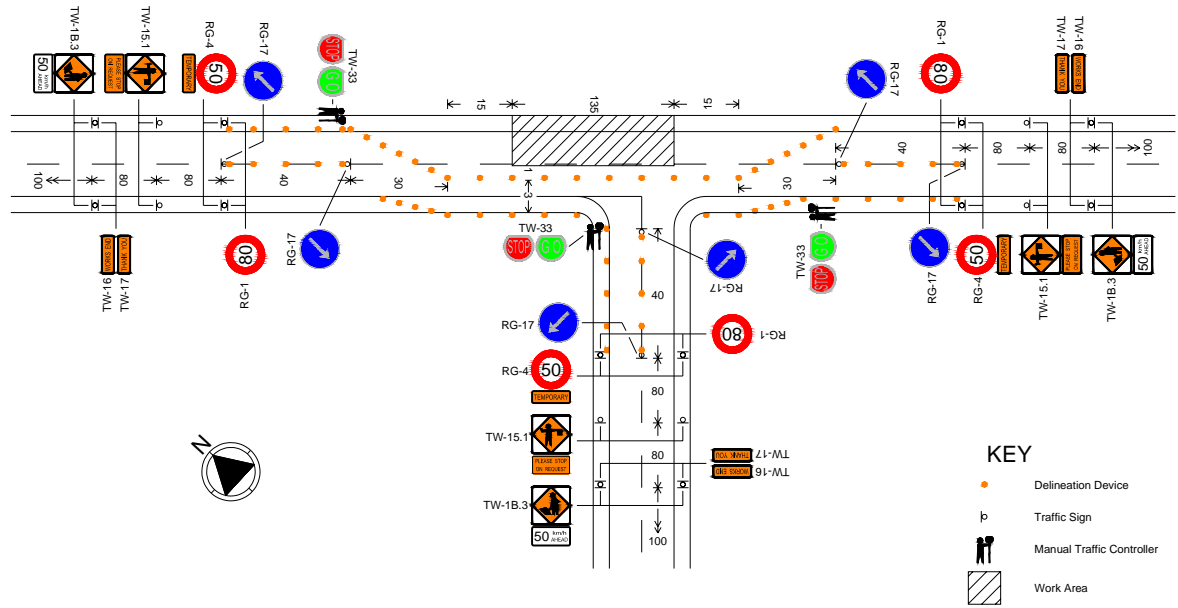


DIAGRAM 2  
 Schematic form of various sections of a work site



**DIAGRAM 3**

A fully interpreted site-specific temporary traffic management control plan  
 This plan consists of four connected “building blocks” and was created from scratch  
 In just a few minutes using CONE (more info at [www.conesoftware.com](http://www.conesoftware.com).)