ITS Radar Helpdesk Query: Gantry Maintenance-Update

Query no:	18	Query initiator:	Robert Stewart
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Query topic areas:	Servicing lightweight gantries		
Categories and level of relevance:		Traffic Management Technology	Relevant
		Traffic & Travel Information	Not Relevant
		Safety	Very Relevant
		Technology Solutions	Very Relevant
Transferability to Highways Agency:		Meets Policy Objectives	To some extent
		Cost/Benefits Information	
		Development status	Ongoing
		Innovative	Yes
		UK legal issues	N/A

Summary:

Highway gantries, used to support many ITS devices, are being redesigned to try and introduce lighter weight materials that will reduce cost and provide greater passive safety. These lighter designs do not have walkways and platforms for maintenance, inspection and repairs. Currently the Highways Agency uses "cherry pickers" to maintain 'lightweight' style gantry structures on the M42 motorway.

Although 'lightweight' gantries are relatively new to the United Kingdom, they have been used in other parts of the world for many years. This update presents information on how ITS devices on lightweight gantries are serviced and explores some of the maintenance methodologies used in other parts of the world.

Investigating gantry maintenance in other countries revealed that the most common method for maintenance was the use of an aerial lift ('cherry picker') typically involving traffic flow restrictions to complete maintenance. In some countries such as the United States, partial rather than full closures of carriageways are commonly used. Other methods of maintaining equipment on lightweight gantries included free climbing by staff when secured with lanyards and use of ITS devices which can be moved to the side of the carriageway through use of an electro-mechanical winch.

Use of electro-mechanical winch equipment reduces the need for road closures, but may mean increase routine maintenance costs for maintaining the electro-mechanical winch equipment. Free climbing such structures even attached with a lanyard is unlikely to be appropriate given the nature and location of these structures.

If one assumes that in the majority of situations, a cherry picker or scissor lift will be the most appropriate access mechanism, then consideration should be given to:

	a) minimising the time and level of disruption associated with road or lane closures; b) minimising the frequency of equipment maintenance. Lighter gantry construction materials should be considered including aluminium and carbon fibre. New lighting technologies such as electro-luminescent signs or enhanced retro-reflective sign technologies could be used to remove the need for additional luminaires and associated maintenance requirements. Making more equipment plug and play and rapid repair techniques such as the use of fibre reinforced polymer wraps could also be used to reduce servicing requirements.

Introduction

The Highway Agency has traditionally constructed highway gantry structures for supporting ITS devices using a rigid steel portal frame design. This type of gantry is shown in Figure 1. This design typically included maintenance platforms and walkways. Currently newer designs are being developed using lighter weight materials. These new gantries, already in use on the M42, do not have walkways and maintenance platforms for maintenance, inspection, and repairs. This requires different maintenance methods to be used.

This document explores the different lightweight gantries and their servicing requirements, looking at continental Europe and the United States and discusses the maintenance issues and procedures associated with them. Gantry use in Asian and Pacific countries was also researched but not directly relevant information has yet been identified.

Figure 1 Traditional Gantry Design with Maintenance Access (Source HA)

Gantry Use in the United States

In the United States, gantries and other sign support structures are commonly constructed of lightweight materials such as aluminium. Frequently these lightweight support structures do not have walkways available for servicing them requiring other maintenance methods.

The Federal Highways Administration (FHWA) provides guidelines for servicing gantry structures[1]. The most common way noted for inspecting sign structures was using an aerial lift ('cherry picker', referred to as a bucket truck in the United States). Free climbing of sign structures is also noted as being permitted in some instances, but only when the necessary safety requirements can be met. Typically this requires use of a two lanyard system where one lanyard is always secured to the structure. The FHWA guidelines recommend that inspection work be done during daytime hours for overhead signs, since small fatigue cracks in a typical sign truss are difficult to spot during daytime inspection hours, and are therefore even more difficult to spot during time periods with less light. If inspections are done at night, they recommend providing adequate additional lighting. The guidelines also note that it is only required to have a partial carriageway closure to service gantry structures in many instances.

The guidelines recommend developing a plan to determine the optimal method of servicing each sign structure by developing a cost benefit ratio. The cost benefit ratio takes into consideration the various safety aspects affecting the maintenance personnel and the passing motorists. It should also take into consideration Maintenance of Traffic (MOT) requirements and keep controlling costs within acceptable limits. No examples of these plans were found but if additional details are needed, the FHWA could be contacted for additional information.

In some parts of the United States innovative techniques have been developed to reduce the time and resources required for the repair of lightweight sign structures. One such technique is the use of fibre-reinforced polymer (FRP) composite to wrap cracked joints in aluminium overhead structures. This technique allows a cracked aluminium joint to be repaired in three hours by three workers for a cost of less than $3,000[2].

One vendor in the United States has developed electro-mechanical cable and pulley systems for VMS. This system, the ADDCO Brick Trak™, allows signs to be moved to the side of a carriageway where maintenance can be performed[3]. ADDCO has been contacted to obtain additional information on their pulley systems. If further useful information is received we will issue a query update.

Gantry Usage in Continental Europe

In France as well as many other continental European countries, historically there was a lower traffic density than is found in the United Kingdom[5]. This resulted in greater use of lighter weight gantries as the risk of major incidents due to gantry collapse was considered less likely. French gantries are predominantly built using aluminium and servicing is typically done with an aerial lift ('cherry picker')[4].

One innovative way of maintaining equipment on gantries can be found in Denmark. A recent study visit by the HA indicates that simple A-frame gantries, used during road construction, have been devised to carry ANPR, lane signals and a VMS. Devices on the gantry are moved laterally by an electric motor to support revised Traffic Management strategies[6]. This reduces the amount of time required to restrict the flow of traffic. A call report on this type of gantry can be found in the ITS Radar Library. Charlotte Vithen from the Danish Road Directorate has been contacted to obtain more information on this form of equipment maintenance. This query will be updated when we receive additional useful material. A photo of the Danish A-frame gantry is shown in Figure 2.

Figure 2 Danish A-frame Gantry (Courtesy HA)

'Lightweight' Gantries on the M42

Figure 3 Lightweight Gantry on the M42 (Source HA)

A new 'lightweight' style gantry design (although still using steel construction) currently in use on the M42 is shown in Figure 3. In developing this gantry design, a number of different new technologies were investigated to reduce maintenance related road closures. Electro luminescent fixed plate signs[7] and retro-reflective sign materials were considered, but these technologies weren't found to be reliable enough at the time of the design (2003). Electromechanical mechanisms for moving fixed plate signs across different lanes were explored, but the pulley mechanisms themselves were found to have substantial maintenance requirements. As a result, the lane independent fixed signing approach now in place was developed and maintenance practices were developed for servicing this type of gantry involving temporary night time road closures and use of an aerial lift ('cherry picker')[8].

The new gantries were designed to enable quicker maintenance of the Advanced Motorway Indicators. These were designed as plug and play with a quick release mechanism allowing them to be removed and taken off-site for maintenance[9]. They also have a longer design life which will mean reduced carriageway closures associated with gantry replacement[8].

Conclusions

Investigating gantry maintenance in other countries revealed that the servicing methods available for maintaining lightweight gantries are:

- use of an aerial lift ('cherry picker');
- freeclimbing (protected by lanyards); and
- electro-mechanical pulley systems for equipment maintenance.

The most common method for maintenance was the use of an aerial lift ('cherry picker') which involves traffic flow restrictions such as carriageway closures to complete the required maintenance.

International experience suggests that efforts should be focussed on:

- developing gantry designs that inherently minimise maintenance, for example by using corrosion resistant materials;
- be innovating in considering gantry repair techniques (e.g. fibre reinforced polymers for repair of aluminium gantries);
- develop a site specific maintenance regime for each structure appropriate for the situation, minimising the overall cost to the HA & motorist, using the HA Structures Management Information System;
- consider new technology (such as electro-luminescent signage) as it develops, and 'plug and play' equipment to minimise maintenance requirements of ITS equipment and fixed plate road signage.

We are seeking additional information about schemes where electro-mechanical pulley systems have been deployed and can see theoretical value to these where the position of equipment needs to be moved on a regular basis, e.g. within roadworks sections (with particular benefit in over lane signing and potentially speed / PTZ CCTV camera placement) however we suspect that in locations where the pulley system would be used only rarely, (based on previous experience of little used electro-mechanical rotating prism VMS) the maintenance implications related to the pulley system may outweigh the benefits of such equipment.

References

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