CASE STUDY

Use of Compaction Monitoring

Overview

Flannery Plant Hire consistently focus on the use of innovative methods to improve production and efficiency on client sites. We have followed the development of compaction monitoring technology and to assist in the evaluation of its capability we recently completed a trial on a highways scheme in Scotland in conjunction with Balfour Beatty.

What is compaction monitoring?

Compaction monitoring is widely used on construction sites across Europe, and has become mandatory in some regions as a method of validating compaction levels across highways schemes.

The benefits of using compaction monitoring include:

• Live documentation and control of the compaction process

• Compact only to the level required. No over compaction which improves operational efficiency. This reduces fuel consumption and increases efficiency and sustainability.

• As compaction levels are monitored in real-time, thicker layer levels can be achieved; thus further increasing further productivity and performance of equipment.

• Reduced requirement for compaction testing. This reduces the need for engineers to attend site, lowering engineering costs and the risks associated with the people plant interface.

• Instant weak-spot detection enables instant correction and reduces the need for re-work.

• Validation documentation can be provided to clients to demonstrate consistency and quality of output.

Compaction monitoring is not yet used extensively in the UK. However, there is a shift amongst Tier One contractors who recognise the health and safety benefits and cost efficiencies that can be achieved utilising the technology.

A number of roller suppliers are able to provide compaction monitoring technology. The suppliers of GPS are able to offer solutions to provide site mapping. Linking these two technologies provides a picture of the site, demonstrates compaction levels and pass completion (in relation to the construction model).

In addition, Bomag have their own system called Bomap which can use GPS tracking through a tablet positioned in the operators cab.

Site

The trial was undertaken on the A9 Luncarty to Pass of Birnham project. This project is being undertaken by Balfour Beatty and involves the construction of 9.5km of new dual carriageway.

Equipment

To evaluate its suitability for our clients the trial was undertaken with a Bomag 213DH-5 which is a single drum 13 tonne roller. The machine was fitted with Bomag's compaction measurement system which consists of sensors fitted to the vibration system, along with their Bomap cloud-based monitoring system which enables mapping of compaction either through pass count or compaction density.

Testing & Briefing

The roller was delivered on the 27th of November 2019 to the northern extent of the project where work was underway to construct the new south bound carriageway. Representatives from Bomag and Flannery were present to brief both the roller driver and the ganger in charge.

The briefing covered the controls, the readings on the new instruments showing the live compaction in MN/mm2 and input of data to the tablet, including understanding the purpose and function of the GPS monitoring.

The Trail

The GPS mapping system was set to record where the roller had been, and the number of passes made on the subbase. Results were visually reported using an easy to understand colour scheme:

- Red: 0-2 Passes
- Light green: 3-6
- Green: 7-10
- Blue: greater than 10

The Trial cont.

As the roller travelled over the subbase, the tablet recorded and displayed the route taken, changing the colour the displayed path dependent on the number of passes.

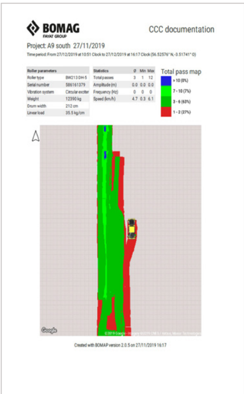
The value of the passes can be entered into the tablet to suit and comply with the HWMS method of compaction. The driver can then see if he has missed an area or covered and area too many times.

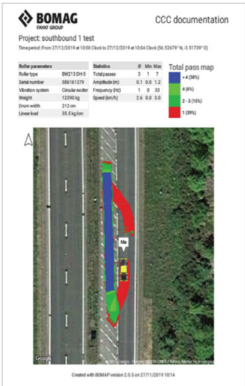
The sensors in the vibration system also provides live compaction readings giving real-time feedback on the stiffness value as the material is compacted. If the cursor on the tablet is moved by hand to a particular point on the map screen, the display immediately indicates the stiffness at that point.

The Results

On completion of an area, the material was tested by conventional forward tipping dumper apparatus from the UKAS laboratory on site. Although the readings were not the same, there was a clear similarity
representing areas that passed or were alternatively required to be removed as a soft spot.

The system was able to provide the operator with live reporting of compaction levels either through pass completion or compaction level. This supported more efficient operation of the roller. This data was then downloaded and provided transparent quality assurance to the client. The system was intuitive and clear colour coding enabled the operator to see which areas were under or over compacted or had achieved the correct compaction levels.





Conclusions

There are obvious benefits of using machine control, from a safety, sustainability and efficiency perspective.

In order to ensure compaction monitoring works effectively it is important that there is early engagement from the site teams to ensure that the benefits is achieved.

It was felt that the testing team should have ownership of the compaction results and be involved with compaction monitoring at an early stage so they can compare readings from the compaction monitoring system with their laboratory testing results to ensure consistency across the project.

In addition, they will then be able to use reporting from the compaction monitoring system for producing validation reports.

The technology is at an early stage of use in the UK marketplace and its important that the technology is embraced and further trials take place in order that we can demonstrate its capability and effectiveness.