Adaptive network control Sitraffic Motion MX

The most intelligent answer to congestion and pollution

www.siemens.com/mobility
Today most cities are confronted with a Herculean task in traffic and environmental policy: They must find a way to enable the existing road network to accommodate an ever increasing traffic load while ensuring at the same time that the defined emission limits are adhered to. With Sitraffic® Motion MX 4.0, the model-based, adaptive network control system from Siemens, they can now achieve both goals at once. In conjunction with a modern traffic computer, this traffic-actuated network control system coordinates traffic light switching for a dynamic “green wave” – for considerably less congestion and pollution. Due to the model-based concept, the achievable positive effects exceed by far the benefits of rule-based systems.

Dynamic “green wave” – for both traffic and the environment

By dynamically coordinating green phases in a street network, Sitraffic Motion MX substantially improves traffic flow. Besides benefiting all road users, these “green waves” have been proven to have a strong impact on fuel consumption and emission levels. Compared to stop-and-go traffic, smooth traffic flow reduces fuel consumption by up to 20 percent and lower nitrogen oxide emissions by up to 50 percent, carbon monoxide production by up to 33 percent and hydrocarbon emissions by up to 25 percent.

Open for traffic control components from a wide variety of manufacturers

Sitraffic Motion MX is the first adaptive network control that is designed for data exchange based on the OCIT® standard. Hence the system is compatible with controllers and traffic lights from virtually all European manufacturers – a considerable advantage for municipalities because no city starts “from scratch” and there is usually already an extensive technical infrastructure installed. Modernization or extension with Sitraffic Motion MX ensures that the existing infrastructure can continue to be used, thus effectively protecting previous investments for the long term.

An innovative solution for a Herculean task
Excellent interaction with the newest simulation systems

Motion MX 4.0 or higher can be linked up with the simulation model Vissim, which simulates traffic in the given road network and makes it possible to calculate the effects of specific parameter settings on traffic. Hence the quality of certain control concepts and their impact on traffic flow can be tested at the workstation well prior to their implementation. Moreover, Vissim allows the creation of valuable simulation studies. So the question if and to what extent the use of Sitraffic Motion MX will benefit traffic control in a specific road network is readily answered.

What is Sitraffic Motion MX?

Sitraffic Motion MX is a software system for installation on modern traffic computers (Sitraffic Scala). The system optimizes the switching of a city’s traffic lights in such a way that traffic moves measurably faster within the existing infrastructure. As Motion MX “keeps an eye” on the entire network and not just on individual intersections and is able to react very quickly to changing traffic conditions, it is by far more effective than conventional traffic light control system alone, because the latter is based on fixed rules.

In version 4.0 or higher, Motion MX uses a newly developed method for estimating traffic parameters and for traffic modeling. Thanks to this method, traffic flow can be improved to a hitherto unattainable degree. And the best thing about it: The detectors needed for all that are usually already installed at the intersections.
Sitraffic Motion is already smoothing the flow of traffic in many cities – for less congestion and less stress. Experience has shown that the system can bring its strengths to bear in projects of all sizes. Wherever Motion MX has been implemented, significantly smoother traffic flow and a substantial reduction in noise and pollutant emissions were the result. These effects could be achieved no matter if the project encompassed 3 or 140 intersections, with Motion MX as stand-alone solution or as integral part of a complex traffic management system.

Example Copenhagen, Denmark: priority for mass transit

The task of the traffic control system to be implemented in Valby, a municipal district of Copenhagen, had been clearly defined by the customer: The system was to make service on the four municipal bus routes 20 percent faster without slowing down private traffic in any way. Sitraffic Motion was not only able to fulfill this task, but even provide benefits in excess of this goal. Before-and-after analyses carried out by the customer showed that Motion shortens travel times for all road users in Valby. Buses now travel up to 27 percent faster with no adverse effect on individual traffic. On the contrary, also private travel speed has increased by up to 6 percent.

Example Münster, Germany: 38 percent performance increase during morning rush hours

In Münster we have equipped the 24 intersections on a 6-km arterial road with coordinated traffic light switching. This dynamic “green wave” has done away with the frequent red-light stops that used to slow down traffic on this important artery. An empirical study of Ruhr University Bochum showed that buses and private cars now lose about one third less time, with the added benefit of burning correspondingly less fuel and producing considerably less nitrogen oxides. Thanks to the adaptive traffic control, the frequency and length of the stops could be reduced by 35 to 45 percent compared to the former situation.

Places where Sitraffic Motion MX* makes traffic move faster

<table>
<thead>
<tr>
<th>City/country</th>
<th>Traffic signal installations</th>
<th>Year installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abu Dhabi, United Arab Emirates</td>
<td>31</td>
<td>2006/2007</td>
</tr>
<tr>
<td>Amberg, Germany</td>
<td>ca 20</td>
<td>under development</td>
</tr>
<tr>
<td>Braunschweig, Germany</td>
<td>5</td>
<td>2005</td>
</tr>
<tr>
<td>Bremen, Germany</td>
<td>9</td>
<td>2004</td>
</tr>
<tr>
<td>Bremerhaven, Germany</td>
<td>14</td>
<td>2008/2009</td>
</tr>
<tr>
<td>Graz, Austria</td>
<td>50</td>
<td>2002/2008</td>
</tr>
<tr>
<td>Heidelberg, Germany</td>
<td>3</td>
<td>2008</td>
</tr>
<tr>
<td>Copenhagen, Denmark</td>
<td>36</td>
<td>2000/2002/2006</td>
</tr>
<tr>
<td>Krakow, Poland</td>
<td>ca 50</td>
<td>2009</td>
</tr>
<tr>
<td>Magdeburg, Germany</td>
<td>14</td>
<td>2005</td>
</tr>
<tr>
<td>Mannheim, Germany</td>
<td>8</td>
<td>2004/2006</td>
</tr>
<tr>
<td>Münster, Germany</td>
<td>55</td>
<td>2007/under development</td>
</tr>
<tr>
<td>Odense, Denmark</td>
<td>31</td>
<td>2001/2009</td>
</tr>
<tr>
<td>Piraeus, Greece</td>
<td>22</td>
<td>1998–2003</td>
</tr>
<tr>
<td>Prague, Czech Republic</td>
<td>21</td>
<td>2005</td>
</tr>
<tr>
<td>Stuttgart, Germany</td>
<td>30</td>
<td>2002–2007</td>
</tr>
<tr>
<td>Vilnius, Lithuania</td>
<td>ca 140</td>
<td>under development</td>
</tr>
<tr>
<td>Warsaw, Poland</td>
<td>ca 70</td>
<td>under development</td>
</tr>
</tbody>
</table>

* Status 2010
Thanks to Sitraffic Motion, the performance index calculated on the basis of quality indicators for all traffic modes (private and public traffic, pedestrians, cyclists) shows a 29 percent improvement during morning traffic.

In Münster, the difference between a traditional rule-based control method for "green waves" and the model-based Sitraffic Motion concept has been especially marked for motorized traffic. While the traditional traffic-actuated control system improved traffic quality by a respectable 13 percent, the adaptive, model-based solution boosted the positive effect to an impressive 35 percent. This exceptional result prompted the traffic authorities in Münster to plan the expansion of Sitraffic Motion to a second model corridor. As the main artery to be equipped with Motion is a problem area in terms of emissions, here the main goal will be to reduce air pollution.

![Performance indices](image)

**Performance indices**

(Waiting times and stops for all road users)

<table>
<thead>
<tr>
<th></th>
<th>Morning rush hour 7.00 to 9.00 a.m.</th>
<th>Afternoon rush hour 16.00 to 18.00 p.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>With fixed-time control</td>
<td>32</td>
<td>35</td>
</tr>
<tr>
<td>With conventional optimization</td>
<td>28</td>
<td>26</td>
</tr>
<tr>
<td>With adaptive control</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>Reduction in %</td>
<td>-13%</td>
<td>-26%</td>
</tr>
<tr>
<td></td>
<td>-38%</td>
<td>-37%</td>
</tr>
</tbody>
</table>

Source: Ruhr University Bochum, Institute for Transportation and Traffic Engineering
Sittraffic Motion MX 4.1: new generation, more performance

Sittraffic Motion MX combines the benefits of central, online-optimized signal coordination with those of a local control system that can respond directly to traffic incidents. This is fully in line with the trend towards holistic consideration of the entire network and makes the system superior to all fixed-time and single-intersection control methods. The system bases its forecasts on current traffic density data across several intersections or ideally even across the entire network covered. Version 4.0 represents another important step forward for Sittraffic Motion MX because now the system has access to the powerful simulation tools of the Sittraffic world, offering substantial advantages for planning, evaluating and commissioning traffic control systems.

Network-wide optimization combined with local flexibility

Sittraffic Motion MX combines the advantages of an adaptive network control system with the operative flexibility of a quick-response local intersection controller. This double advantage relies on the intelligent distribution of tasks between the network control and the local controllers. The network control system provides a frame signal plan, which is updated every 5 to 15 minutes and includes cycle times, phase sequences, green-time split and offset times, while every controller still keeps all operative functions required for controlling private traffic and public transport.

As multidimensional as any traffic situation

Sittraffic Motion MX 4.1 is multidimensional in every respect.

- All control variables of the signal plans are considered: cycle time, green-time split, offset time and phase sequence.
- The system operates on two function levels – on the tactical level at intervals of 5, 10 or 15 minutes (cycle time, average green-time split, basic phase sequence and network coordination), and on the operational level at intervals of 60 to 90 seconds (cycle, current phase sequence) or one second (phase transition switching).
- The needs of all road users are kept in mind: private vehicles, public transport, pedestrians and cyclists.
New simulation options facilitate planning, evaluation and commissioning

Sitraffic Motion MX version 4.0 or higher can be used with the simulation mode of the Sitraffic Scala traffic computer. This means that the efficiency of control concepts can be tested already during the planning phase for traffic signal installations. The system can also simulate the different effects of fixed-time control and traffic-actuated control in terms of their impact both on traffic and the environment. This makes it possible to answer the question which control method will help reduce emissions by which amount long before the system is implemented. And when every component has been installed and the system is being commissioned, the simulation option ensures that right from the start the optimum parameters are selected.

Flexible, modular and well equipped to meet future requirements

Sitraffic Motion MX is modularly designed. Individual modules for incident detection, signal plan evaluation and selection, as well as for signal plan optimization allow very precise adaptation to the individual requirements of every application. The system is also readily adaptable to different control strategies, no matter if the primary focus is on congestion management or on increasing the traffic capacity of existing roads and streets.

Function diagram of Sitraffic Motion MX

- Indicator data acquisition
- Modeling of traffic demand
- Modeling of traffic flow
- Modeling of traffic effects
- Modeling of control measures
  - Calculation of performance indicators
- Signal plan program
- Switching commands
## Technical requirements for Sitraffic Motion MX

**Central level**

<table>
<thead>
<tr>
<th>Component</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic computer system</td>
<td>Sitraffic Scala</td>
</tr>
<tr>
<td>Control method</td>
<td>Sitraffic Motion MX as part of the online control system</td>
</tr>
</tbody>
</table>
| System concept                     | OCIT interface  
   (Open Communication Interface for Road Traffic Control Systems)  
   Canto  
   (Communication in Advanced New Technology in Outstations)  
   Others on request |
| Operator control and visualization | within Sitraffic Scala                                                        |
| for Sitraffic Motion MX            |                                                                               |

**Local level**

<table>
<thead>
<tr>
<th>Component</th>
<th>Specifications</th>
</tr>
</thead>
</table>
| Controllers                        | Sitraffic C800V/C900V  
   Third-party equipment  
   Others on request |
| Control method                      | PDM with MX  
   Other control methods |
| Detector equipment                  | Induction loop detectors  
   Passive infrared detectors  
   Others on request |

---

**For further information please contact:**

Siemens AG  
Industry Sector  
Mobility Division  
Complete Transportation  
Intelligent Traffic Systems  
Hofmannstrasse 51  
81359 Munich  
Germany

www.siemens.com/traffic

The information contained in this brochure comprises only general descriptions and performance features of products and systems, which may not always apply exactly as described in every realized application, or which may be subject to change due to further development of the products. Performance features are only to be considered binding if they have been explicitly agreed in the contract.

---

Siemens AG  
© Siemens AG 2010  
All rights reserved

Sitraffic is a registered trademark of Siemens AG

www.siemens.com/mobility