BEARING CAPACITY IS IMPORTANT

Bearing capacity is an important parameter. Just as important as the compaction degree. PRIMA 100 is easy to use and provides first class measurements of the bearing capacity of base layers. An integrated high precision load cell measures the impact load of each individual measurement providing a correct bearing capacity result irrespective of soil type and material. PRIMA 100 measures on anything from clay to base gravel and crushed concrete. PRIMA 100 applies no radioactive sources. No special training is required for normal daily use of PRIMA 100. PRIMA 100 requires no special transport permits

PRIMA 100 LWD



PRIMA 100 FOR CONSTRUCTION QA AND MONITORING DURING CONSTRUCTION

NATURAL SOIL AND EARTHWORK MATERIALS

Irrespective of whether the soil is to carry a large industrial floor, a road, a parking area or other structures, it is crucial to know the surface bearing capacity on top of relevant layers. Only with this knowledge is it possible ensure a correct and uptimum construction.

PRIMA100 utilises an integrated high precision load cell for the measurement of the impact load of each individual measurement providing a correct bearing capacity result irrespective of soil type and earthwork material. PRIMA100 can measure on anything from clay to base gravel and crushed concrete. Knowing the bearing capacity of the soil and foundation materials ensures that the required performance is achieved.

EXCAVATIONS AND REHABILITATION OF ROAD LANES

Compaction: You can control the compaction degree of the excavated and reused often mixed materials. A correct compaction prevents lasting settlements and defects. Sweco has prescribed a measuring procedure for PRIMA 100 for qualitative compaction control of backfill.

Bearing capacity: Bearing capacity is as important as compaction. The stiffness of foundation layers is crucial in order to avoid cracking. Thus bearing capacity measurements are performed on old foundation layers immediately after the asphalt layer has been removed. The task is then to obtain the same bearing capacity with the new structure - or as close to as possible. In this way the new and the old asphalt will work uniformly and cracks can be minimised. At the end of the day you save money.

PRIMA 100 FOR CONTROL DURING CONSTRUCTION

Apply PRIMA 100 for quality control in connection with construction of foundation layers for roads and other areas. Measuring the bearing capacity on top of the individual layer, you will identify insufficiencies in time and these can be remedied.

Or you may discover that the existing materials are better than expected allowing you to potentially reduce the volume of more expensive material.

Time spent measuring surface modulus can very save money and always ensure construction quality.

PRIMA 100 FOR CONTROL IN CONNECTION WITH RAIL CONSTRUCTION

PRIMA100 is applied for control of natural soil and structure. When constructing foundation layers for track beds, the bearing capacity is essential. PRIMA100 controls the bearing capacity of soil as well as foundation layers under construction. PRIMA100 is applied on a routine basis when replacing crossings.

Compliance with the specifik requirements to soil and base gravel are controlled. The work needs to be performed as quickly as possible because all road and rail traffic has been stopped. The in-situ reading of e.g. bearing capacity, impact, deflection, time, GPS coordinates and automatic storage of data ensure this.

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PRIMA 100 LWD - TOOL FOR UNBOUND LAYERS

PRIMA100 - The tool for unbound layers - The PRIMA100 LWD is the road builders' tool. It is the perfect method for bearing capacity control of subsoil and foundation layers – sub-base and base course. Proper control of these layers prior to final paving is essential in order to ensure the high and expected quality of your new road. If the bearing capacity of the subsoil or foundation layers fails, the performance of the road fails. You will soon experience rutting and cracking. The road becomes uncomfortable and will need repair much earlier than expected. Other typical applications for the PRIMA100 include measurements on e.g. foundations layers for truck terminals, industrial flooring and parking lots. One special application is control of load transfer on industrial flooring using three geophones

PRIMA 100 LWD

PRIMA 100 reads out your results at once. Results are stored automatically together with the GPS position. PRIMA100 applies wireless technology for data collection and is one-man operated

UNIQUE PRIMA 100 FEATURES
Having the results from the PRIMA 100 allows you to simply move on to the next step. Alternatively you have the chance of correcting failures at an early stage. And it is much cheaper to correct at an early stage than to repair at a late stage.

MEASURING APPLIED STRESS IS IMPORTANT
The PRIMA 100 is the only LWD utilising the technique from the big traditional FWDs with an integrated load cell. Consequently the PRIMA 100 registers the variation of the applied stress transferred to different (sub)soils using the same weight drop height. A variation that may be substantial and therefore has to be taken into consideration to achieve reliable E0 results and hence to make the correct conclusions!

TO UNDERSTAND THIS IMAGINE:
Place a thick wooden plate on your floor and alongside that place your mattress. Hit the wooden plate and the mattress with your hand! Besides the fact that you hurt your hand when you hit the wooden plate, you will also intuitively understand the difference in energy transfer and hence the difference in applied stress. Now, if you imagine that the wooden plate is a stiff soil and the mattress is a weak soil, you realise that you always need to measure the applied stress.

This is the reason why this LWD generates reliable results.

DATA PRESENTATION/DOCUMENTATION
After a measuring campaign or any time during a campaign, data can be seen on the display. Either each individual drop or the entire series of measuring points. Data can be transferred to Excel or Word. This allows printing of data for further interpretation or direct presentation in a report as documentation towards e.g. a client.

THE EQUIPMENT
is delivered with a 100 mm and 300 mm diameter loading plate, a 10 kg weight, integrated load cell and electronic box and a centre-mounted geophone, a CAT SmartPhone with a data collection program installed is required.

The PRIMA 100 method is quicker than the isotope measuring method and requires no reference measurements

The equipment has no radioactive sources requiring safety courses

PRIMA 100 applies wireless technology for data collection and is one-man operated

Extension to three geophones is possible.

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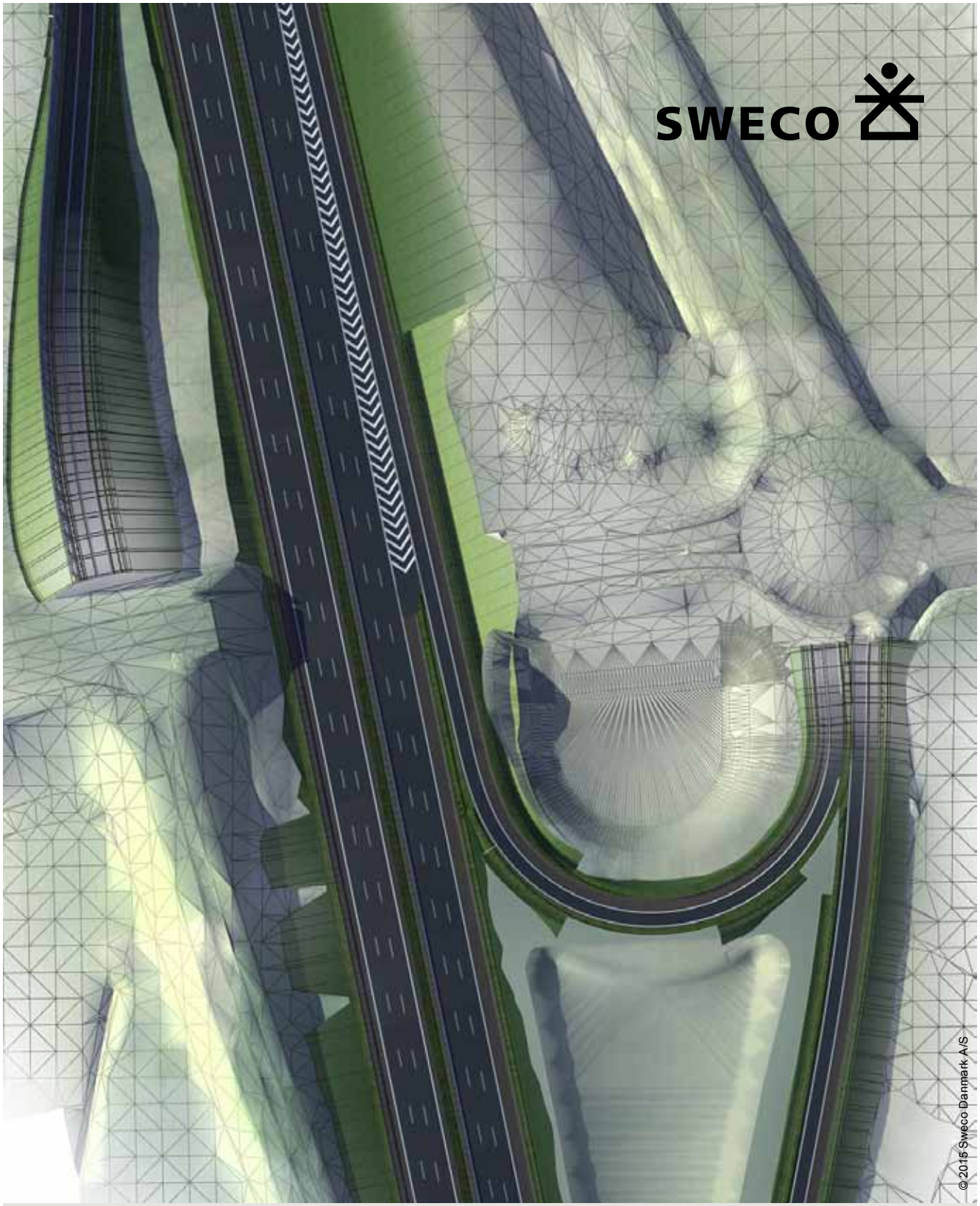
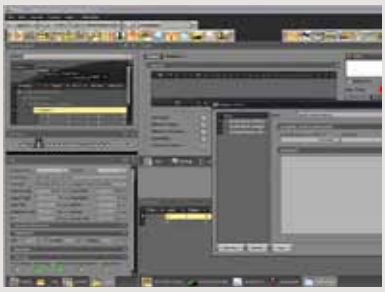
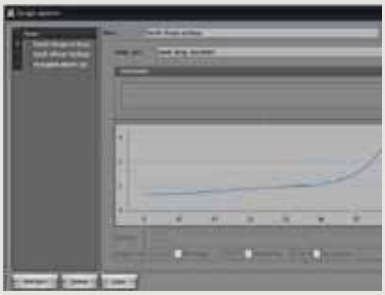


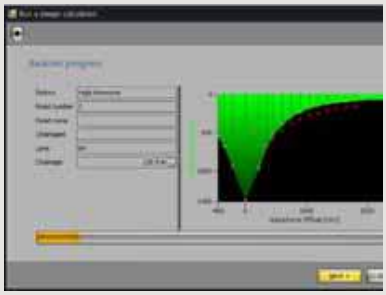
SUSTAINABLE DESIGN FOR THE FUTURE

KEY FIGURES: • Back & forward calculation, PRIMAX MET or PRIMAX LET • Calculation based on 18 sensors • Multiple calculation engines • Overlay (optimize reinforcement) • Critical layer • E modulus for up to 10 layers • Service life • Design options • Design options

PRIMAX DESIGN - roads and airports







PRIMAX DESIGN - MAKING A DIFFERENCE

PRIMAX Design is the software applied for processing data collected by the PRIMAX FWD. The analyses and calculations made with the system provide road and airport authorities with valuable information about road and airfield pavements allowing decision-makers to make the right decisions with regard to reinforcement needs or maintenance strategies that will ensure safe roads and runways

RESULTS ON SITE

PRIMAX Design integrated in the PRIMAX survey software allows the operator to analyse deflection and load signals at any measured point on site. Results can be presented for an entire road network, per section and per measuring point with specifications of applied calculation parameters.

PARAMETER SETUPS FOR SEVERAL PROJECTS

A large amount of parameter setups can be stored allowing the operator to select the best suited parameters for a particular project. By splitting setup parameters into several levels, combinations can be selected and stored to be used again for projects with similar conditions.

OUTPUT AIRFIELDS

PRIMAX design provides layer moduli, residual life and reinforcement need for all analysed points as well as per section. PCN values (Pavement Classification Number) are determined for individual pavement sections on the basis of calculated field data. To determine whether the existing pavement is capable of carrying a given aircraft, the calculated PCN value is compared to an aircraft's ACN value (Aircraft Classification Number)

OUTPUT ROADS

PRIMAX design provides layer moduli, residual life and reinforcement need for all analysed points as well as per section.

RoSy RAMS/APMS is a modular system, which is normally supplied with a data base module, which may be extended as required.

BACKCALCULATION METHOD - TECHNICAL INFORMATION

PRIMAX Design uses various backcalculation methods. Calculation of deflection of pavement surfaces are based on the theory of elasticity and the method of equivalent thickness, as framed by J. M. Kirk and N. Odemark on the basis of Boussinesq´s equations or optional by BAKFAA developed by FAA and based on linear elasticity theory.

Calculation of reinforcement is based on fatigue relations and the stresses and strains caused by the actual traffic for which calculation of necessary overlay is required. For aircraft loads, the areas, on which overlap is found, the equivalent factors are found by calculation of the fatigue caused by the individual aircrafts in correlation to the fatigue caused by the Design Aircraft.

Key Features:

- Calculation based on 18 sensors
- Overlay (optimize reinforcement)
- Critical layer
- E-modulus up to 10 layers
- Service life
- Design options

Sweco plans and designs the communities and cities of the future. Our work results in sustainable buildings, efficient infrastructure and access to electricity and clean water. With 14,500 employees in 15 countries, we offer our customers the right expertise for every situation. We carry out projects in 70 countries annually throughout the world. Sweco is Europe's leading architecture and engineering consultancy, with sales of approximately SEK 15.2 billion (EUR 1.7 billion) (pro forma 2014). The company is listed on NASDAQ OMX Stockholm AB.

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Safe operation...

Gain knowledge and optimise investments

Safety and quality

PRIMAX
Falling Weight
Deflectometers

Pavement Consultants

Do your pavements match the loads

Monitoring of your pavement conditions is a must to secure a smooth and safe operation of the airport. Today most airports around the world experience a steadily increasing in- and outgoing air traffic as well as new aircraft types subjecting the pavements to much higher loads. The PRIMAX Heavy Weight Deflectometers are all about ensuring a safe infrastructure to move people and goods around in an environmentally safe and sustainable wayr.

Grontmij

PRIMAX 1500 - Roads

PRIMAX *innovation with excellence*

Structural behaviour of pavements

Every day your road pavements are subjected to the load of the traffic driving on them. When the roads were constructed, design was calculated with regard to the load the pavements should be capable of carrying. However, do the actual values match the design? If not, the pavement may fail prematurely and over time, you will see accelerated deterioration with expensive consequences. Monitoring the pavement layer conditions with FWD equipment ensures you early warnings of structural deterioration.

Utilising a Falling Weight Deflectometer, you can collect data to support the optimisation of pavement maintenance budgets.

Analysing and calculating data collected with PRIMAX with the integrated PRIMAX design software allows you to assess the development of road pavement layer conditions throughout the road network:

- Dynamic E moduli
- Remaining service life
- Determination of critical layer
- Reinforcement (overlay) requirements

PRIMAX – reliable, efficient and collaborative

Reliability and quality assurance

- Knowhow of producing Falling Weight Deflectometers since 1965
- Accurate data output with high repeatability and reproducibility
- Supplied, tested and applicable under worldwide climate and weather conditions
- CE marked quality tested durable components
- Quality certified company - ISO 9001, 14001, OHSAS and AASHTO R-32
- 24 month product warranty on PRIMAX

Efficient product solutions for optimum safety and performance

- Automated equipment safety monitoring and warning system
- Cost and time reducing product solutions for surveys
- Scalable load options - upgradable on demand
- Project navigator for project management

Collaborative software solutions

- On-line support integrated for remote system monitoring & support
- Fully linked and aligned with RoSy for easy import/export of data
- Real time data calculation of E moduli during field surveys
- Quality supervision with PRIMAX observer.

PRIMAX 3500 - HWD

PRIMAX 2500 - HWD

PRIMAX 1500 - FWD

One unit with 3 options

Grontmij is a leading European company in the Consulting & Engineering industry with world class expertise in the fields of energy, highways & roads, light rail, sustainable buildings and water. Our leading principle is Sustainability by Design. This enables our professionals to support clients in developing the built and natural environment. Established in 1915, Grontmij is listed on the NYSE Euronext stock exchange.

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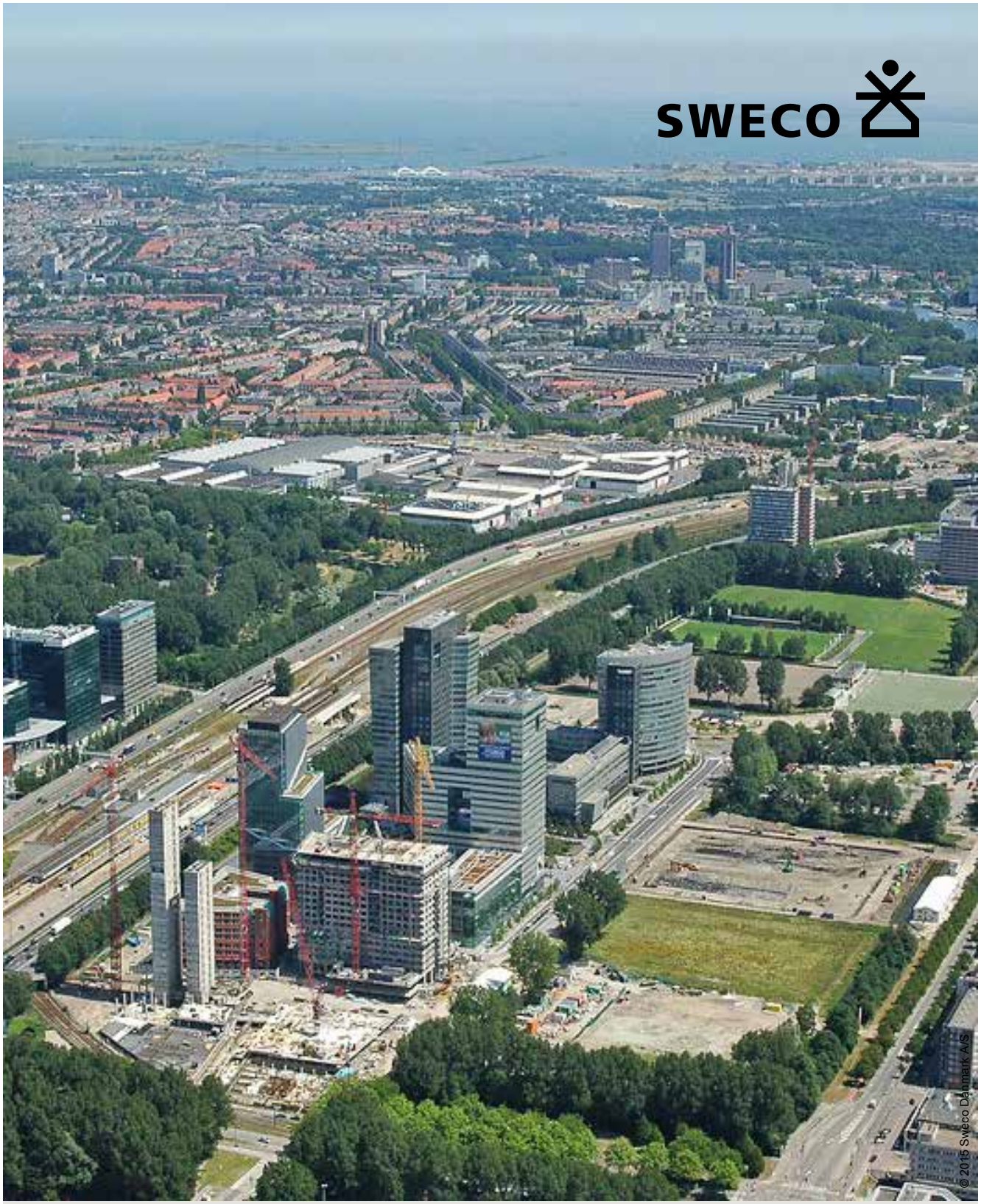


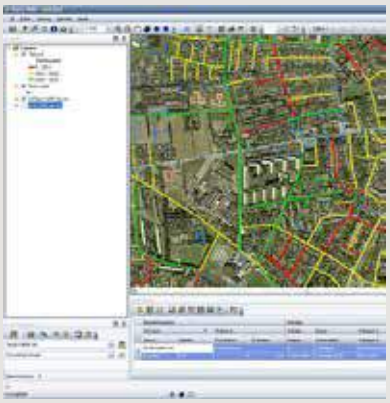
ROSY RAMS - ROAD ASSET MANAGEMENT SYSTEM

RoSy is a concept, which creates the logical connection between decision-makers, the financial consequences and the measures that are made on the individual road sections in order to comply with the political goals and strategies. Proper Pavement Management is cooperation between qualified human resources and software. The road engineer must understand and respect the context, the software programs must form the basis for quality decisions to be taken by the political decision-makers

RoSy RAMS

RoSy BASE - Road survey, main info, width, pavement, road side elements, distress.

RoSy PLAN - Graphic presentation of results.



RoSy MAP - Residual life.

THE HUMAN FACTOR

Software programs cannot replace humans, but they can systematically collect and process large amounts of data and present the results in a clear and well-arranged way.

Because the human factor is so important, we offer to put our experienced pavement management experts at your disposal to ensure that the investment in a pavement management system will give full benefit and that the actual purpose of a PMS - optimum and longterm maintenance - is complied with technicians and engineers of a customer. If such data already exists, then this data can usually be transferred to RoSy.

When geometric and condition data has been registered, the customer has a modern and unique database. Supported database formats are Microsoft SQL server and Oracle. This ensures communication with other systems such as sewerage registers and geographic information systems (GIS).

ROSY BASE

RoSy BASE is the database module of the RoSy family. RoSy BASE supplies the data forming the basis of the calculation of maintenance strategies.

ROSY PLAN

RoSy PLAN is the calculation module, which calculates the optimum long-term and short-term maintenance strategies. The calculation models, which RoSy PLAN uses in the calculations, are based on many years of observations and analysis of distress developments on many types of pavement structures.

ROSY MAP

RoSy MAP visualises data from all RoSy modules and gives a unique visualisation of data and maintenance strategies on interactive maps.

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SWECO CALIBRATION CENTRE

SWECO also perform FWD/HWD calibrations according to SHRP-LTPP ASSHTO R32-11 protocol. AASHTO Materials Reference Laboratory US are responsible for the ASSHTO R32 FWD calibration protocol.
SWECO is the only ASSHTO certified FWD calibration centre outside of Northern America. The certifications are controlled and issued by AMR, US. Please visit AMRL´s homepage for more info
http://www.amrl.net/Amrlsitefinity/default/fwd/fwd_certifiedoperators.aspx

SWECO offer calibrations on all brands of FWD/HWDs (Dynatest, KUAB, Gils, Ect) according to the SHRP-LTPP AS-SHTO R32-11 protocol.

Calibration is important

CALIBRATION IS IMPORTANT FOR DATA QUALITY

Sweco has, as the only manufacturer, based its calibration programme on CROW (Preliminary Guidelines for Falling Weight Deflectometer Calibration). First of all, this programme was chosen because it has been developed for FWDs operating with load pulse widths within the range of 20-35 ms and in our opinion, this procedure provides the best calibration result - and it is an European standard. CROW operates with the following calibration procedures (protocols A-G):.

A. Relative Calibration Verification of FWD deflection sensors
B. FWD short-term repeatability verification
C. FWD long-term repeatability verification
D. Reference LVDT calibration procedure (Linear Variable Differential Transducer)
E. FWD deflection sensor calibration Verification
F. FWD group field calibration procedure
G. FWD field calibration

Sweco FWD calibrations are performed on the basis of Protocols A, B, D and E (Protocols C, F, G are for more comprehensive analysis programmes in which Grontmij takes part every time the Study Committee P8 and CROW arranges comparison tests among various FWD brands).

SWECO CALIBRATION EQUIPMENT

Sweco has developed calibration equipment, which works with the newest technology and principles within this sphere. Furthermore, the equipment is portable allowing us to perform onsite calibration at customers' premises.

THE CALIBRATION PROCEDURE

When Sweco calibrates geophones (displacement transducers), three different calibration parameters are used:

- Cut off frequency
- Slope

The off set and the natural noise have influence on the analog card and the channel. The system compensates for this automatically. This means that in practice the value is 0.
Cut off frequency is the exact frequency where the system must compensate for the non-linearity in the low frequency range.
Slope is the amplification required to make geophone and calibration reference show the same peak value.

The three software values have the advantage that they do not change over time and the current development of the calibration can be followed.

Calibration is done at a given rise time (frequency) and peak value, which may be changed by the operator as required. When the system has automatically found offset, cut-off frequency and slope, a test drop is made with the found calibration data. The operator can now decide whether or not the found values are acceptable.

Calibration according to:

- SHRP-LTPP ASSHTO R32-11 protocol
- The only ASSHTO certified FWD calibration centre outside USA
- SWECO offer calibrations on all brands of FWD/HWDs (Dynatest, KUAB, Gils, Ect) according to the SHRP-LTPP ASSHTO R32-11 protocol

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