

## Kinematic High Resolution Imaging System

Till today, there are still limitations of how structural cracks can be detected and documented automatically. In Singapore, these inspections are usually carried out by a Professional Engineer (PE) carrying out visual inspections on the concrete structures and manually documenting the cracks sighted. However these cracks documentations are still limited to the eyesight and judgement of the PE, especially with fine cracks on the ceiling of tunnels.

Ryobi G see this as an opportunity to partner with a Swiss company, Terra Vermessungen, that is in its advance stage of developing systems that can capture high resolution images kinematically and tagged with geo-referenced information. The System comprise primarily a geo-reference positioning unit, high speed industrial line cameras, high lumen collimated lights, and a high performance industrial computer.



Fig 1: Kinematic High Resolution Imaging of track slab

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### ***"Advanced Modular System Design"***

*One of the key advantages of Ryobi-Terra system is its versatility to suit any site conditions and sensors required for each projects. The positioning unit can either use odometer, GPS system Inertia measurement unit (IMU), or a combination of all abovementioned to achieve the optimum positioning accuracy. Recently, we use this system to acquire the high resolution image of a concrete tunnel crown and train slab. Since this work is in a tunnel without access to GPS, the system has been configured to geo-reference the image with a simple odometer.*

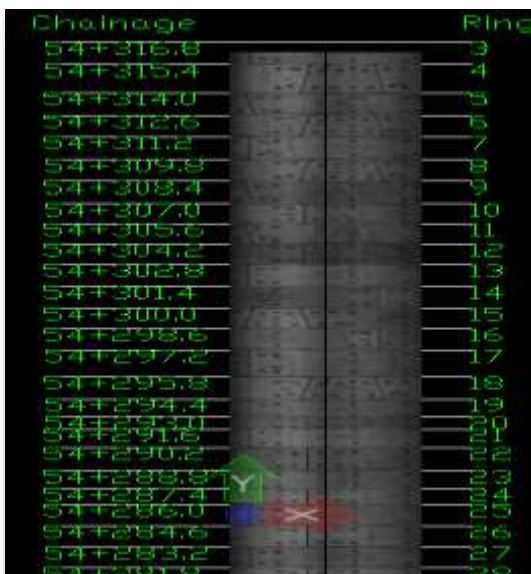
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#### ***"Combination of high performance line cameras and lightings"***

The special lighting allows the line cameras to capture sharp and clear images in the kinematic mode. The images are tagged with chainage by the positioning system in realtime, this allows engineers the possibility to locate and detect the cracks from the images at the comfort of their desk instead of the hot and humid tunnel conditions. The captured images comes with a scale for the engineers to determine cracks dimension as narrow as 0.3mm.



**Fig 2. Part of continuous Hi-Res Image of tunnel crown**



**Fig 3. Geo-referenced Image**

#### ***"Geo-referenced Documentation"***

Having captured the full surface of the tunnel in high resolution images, there is almost no limitation on inspection of cracks or defective fittings along the tunnel at the comfort at desk.

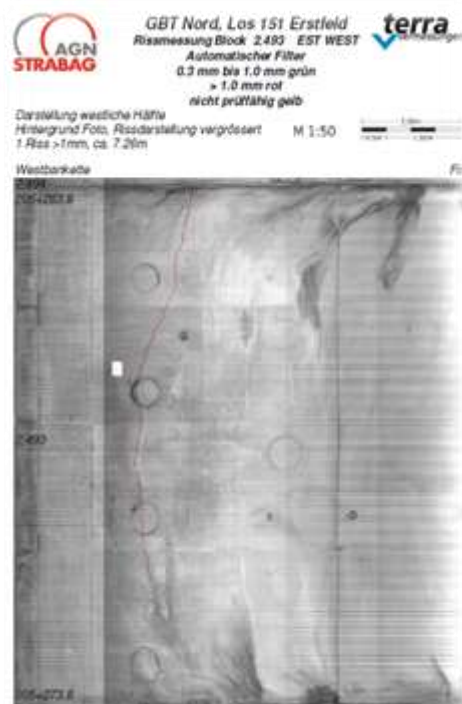
The images are tagged with chainage by the positioning system in realtime, this allows engineers the possibility and ease to identify the location of defects detected such as cracks from the images at the comfort of their desk instead of the warm and humid tunnel conditions.

**Fig 4. Cracks measurement and profiling**



### ***"Classification of Cracks"***

The special lighting provides parallel beam of high lumen light source allowing the line cameras to capture sharp and clear images in the kinematic mode. The captured images comes with a calibrated scale for the engineers to determine cracks dimension as narrow as 0.3mm. Engineers can then classify the cracks which needs to be repaired or monitored by highlighting with different colors for respective cracks.



**Fig 5. Classification documents of cracks**



**Ryan Ooi**  
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### ***"Embarking the Future"***

Ryobi Terra is derived at constantly developing and upgrading the system to keep pace with the challenges that engineers faced in the ever growing infrastructure and maintenance requirements in Singapore and the region. Should you be interested in the above services, kindly contact us.

Sincerely

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