Pavement thickness evaluation with non-destructive methods

Comparison study

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Introduction

- So far **coredrilling** (8 cores/km) is predominantly used for evaluating pavement layer thickness in taking over process of new pavements in Estonia
- Coredrilling is **accurate but** timeconsuming, costly and destructive method, providing very limited information about thickness being very local
- New promising **nondestructive methods** have been implemented worldwide, promising to eliminate shortcomings of coredrilling method
- ND GPR **already in use** for air-voids measurements

Study contents

- **Literature review** of different nondestructive pavement thickness measurement methods and selecting most promising
- Preparing **measurement procedure** for installation of reflectors for measuring eddy currents in
- **Field tests** with different nondestructive measurements and traditional coredrilling
- **Comparison of results**

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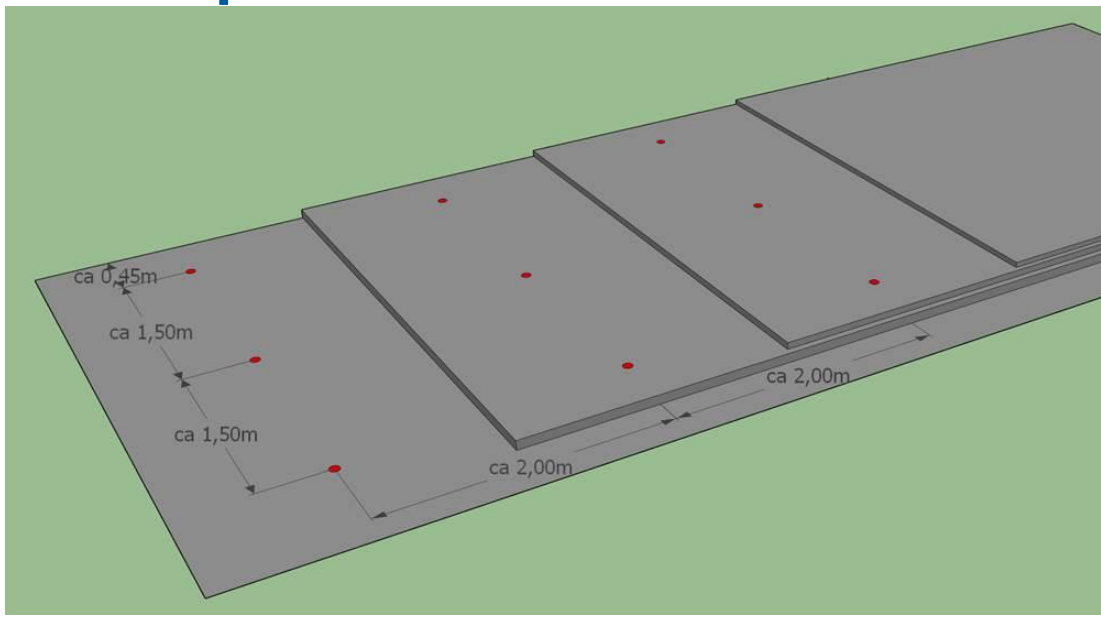
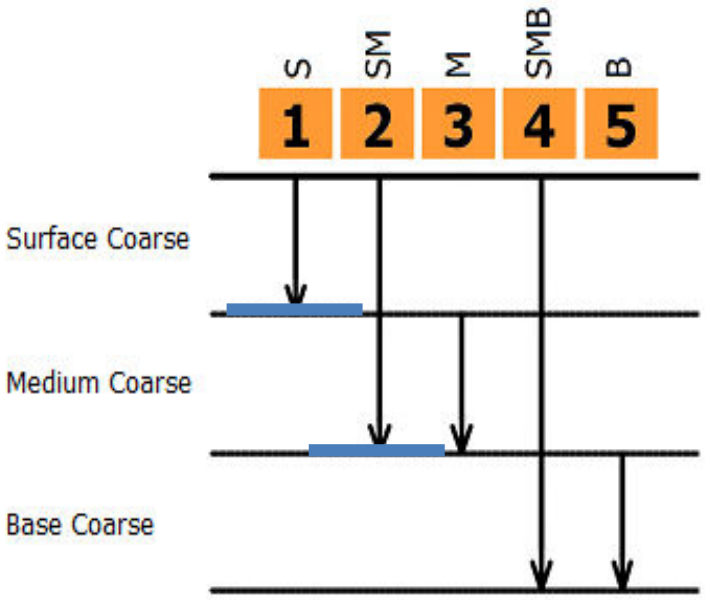
Literature review

- Based on literature review, following methods and devices were selected for field test:
  - **Ground Penetrating Radar** (GSSI SIR-30)
  - **Eddy Currents in Reflectors** (MIT-SCAN-T3)
  - **Geodetic measurements**
  - **Coredrilling** & thickness measurement in laboratory (reference)

MIT measurement procedure





3 = 2 - 1

5 = 4 - 2

5 = 4 - 3 - 1

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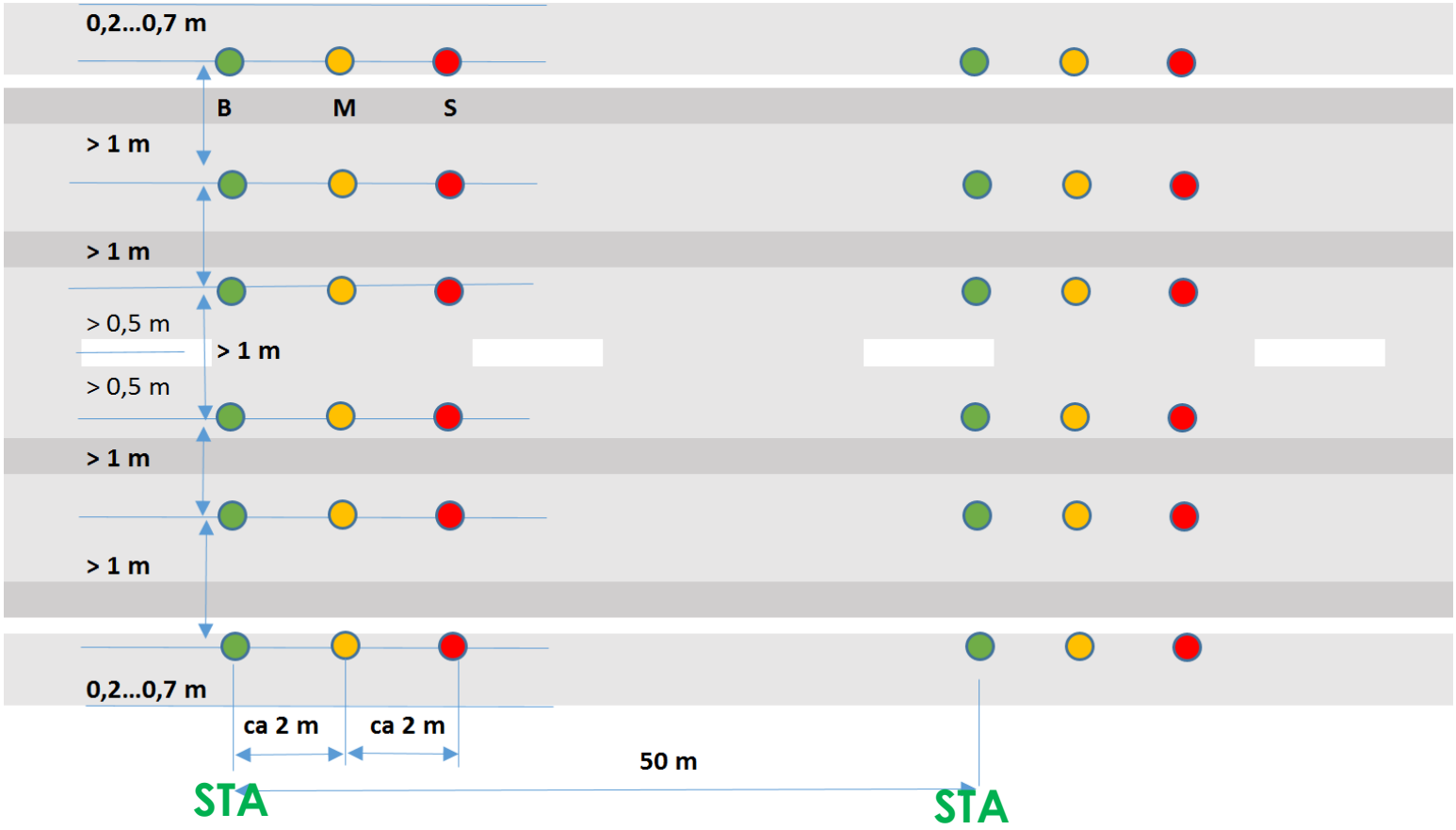
Reflectors installation scheme



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Field tests

- Studies carried out in **3 sites**, ca 2 km each
- All sites comprised of **2-layer** pavement
- **10 cross-sections** were selected in each site for comparison with **coredrilling**
- All measurement places (reflector points) were also measured **geodethically and with GPR**

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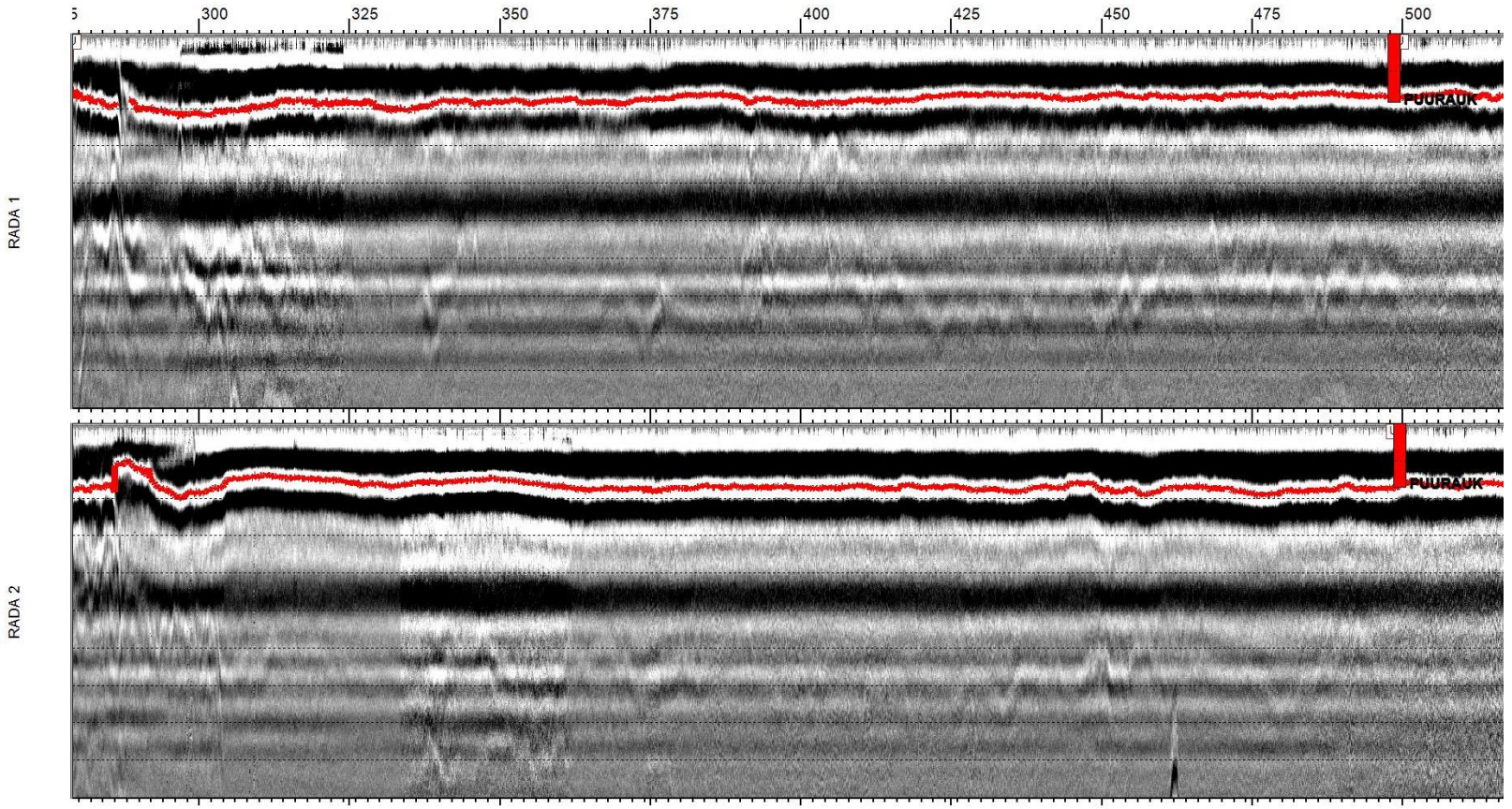
2-layer thickness with GPR



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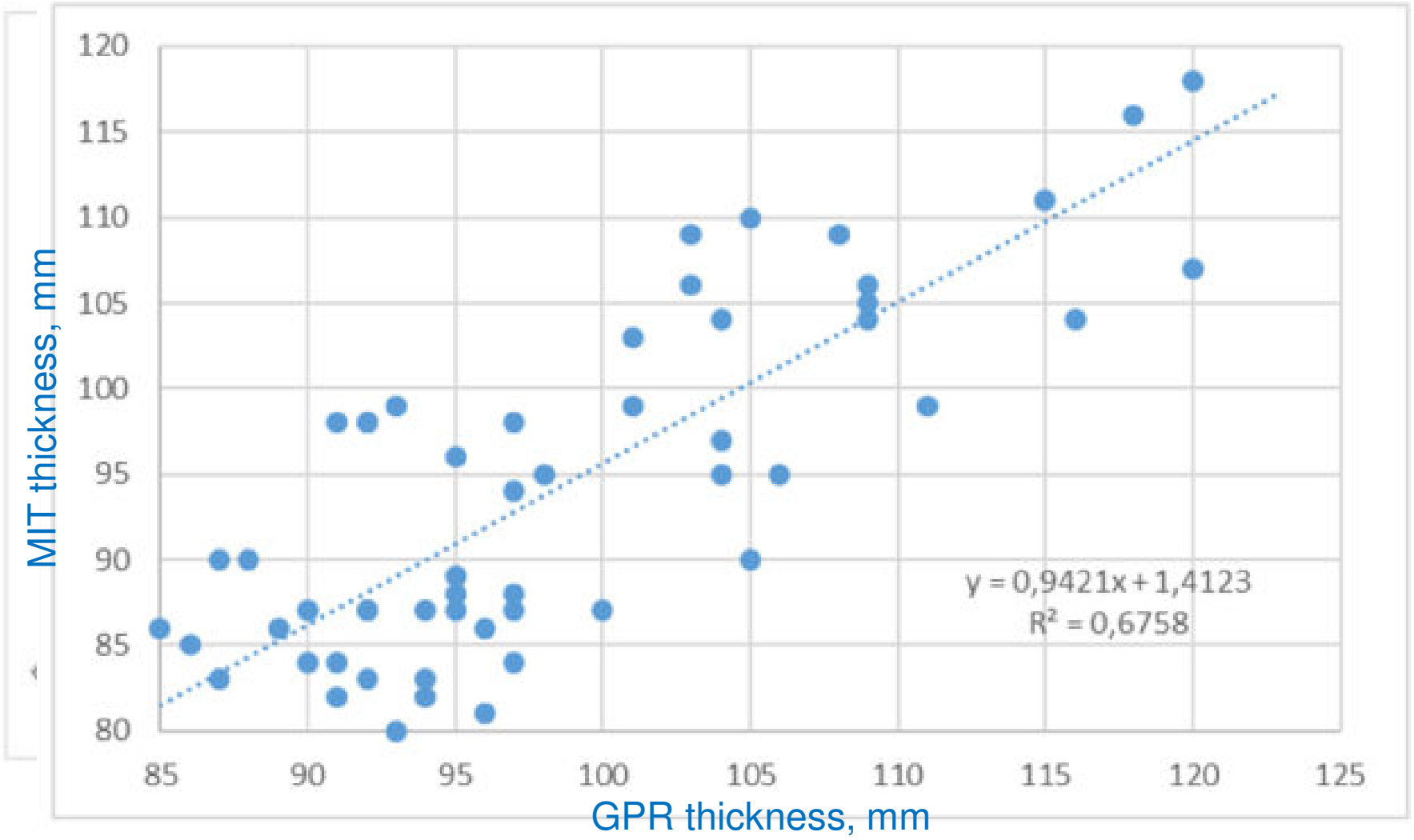
GPR vs MIT (2 layers: surf+base)



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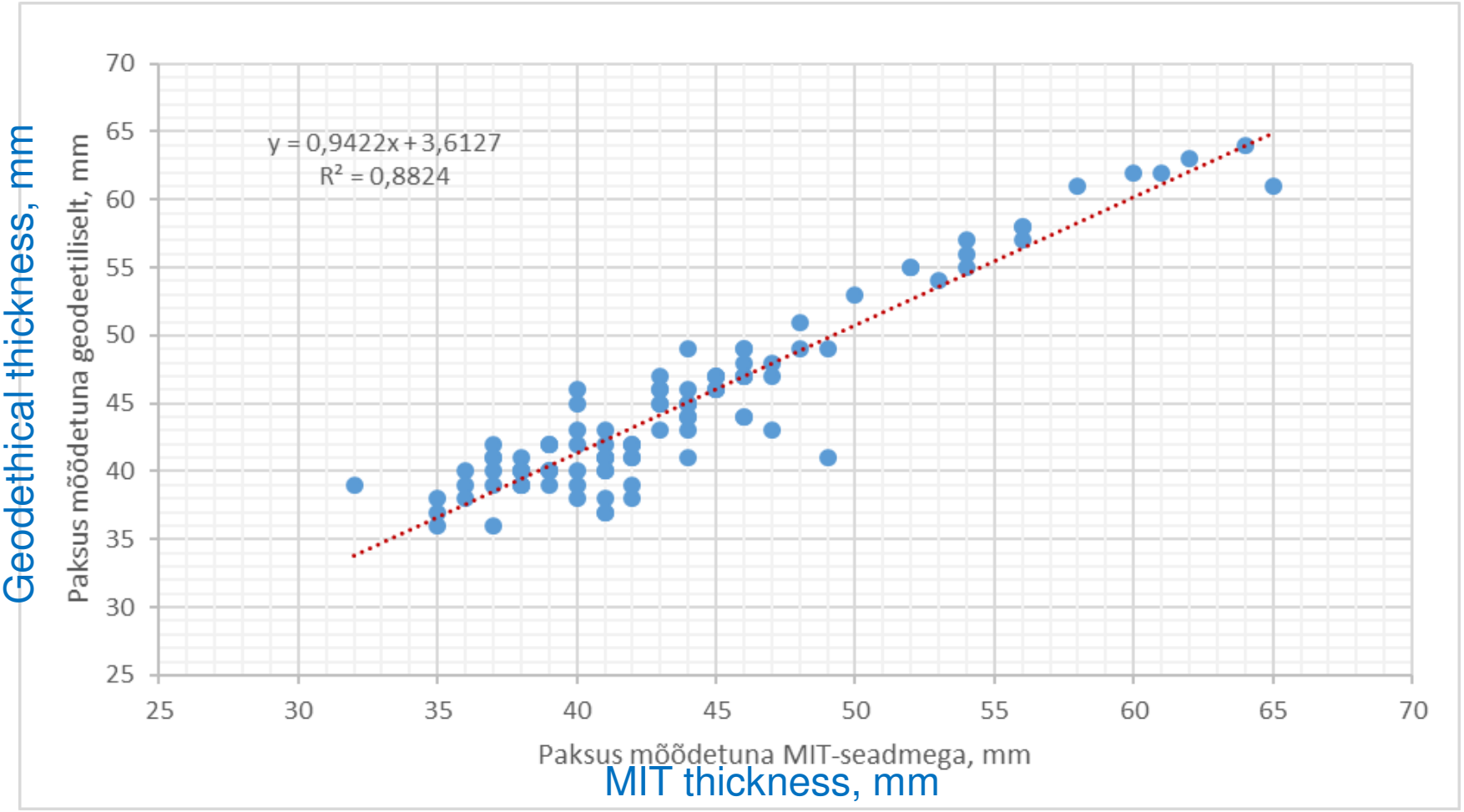
MIT vs Geodetic (surf in center of pavement)



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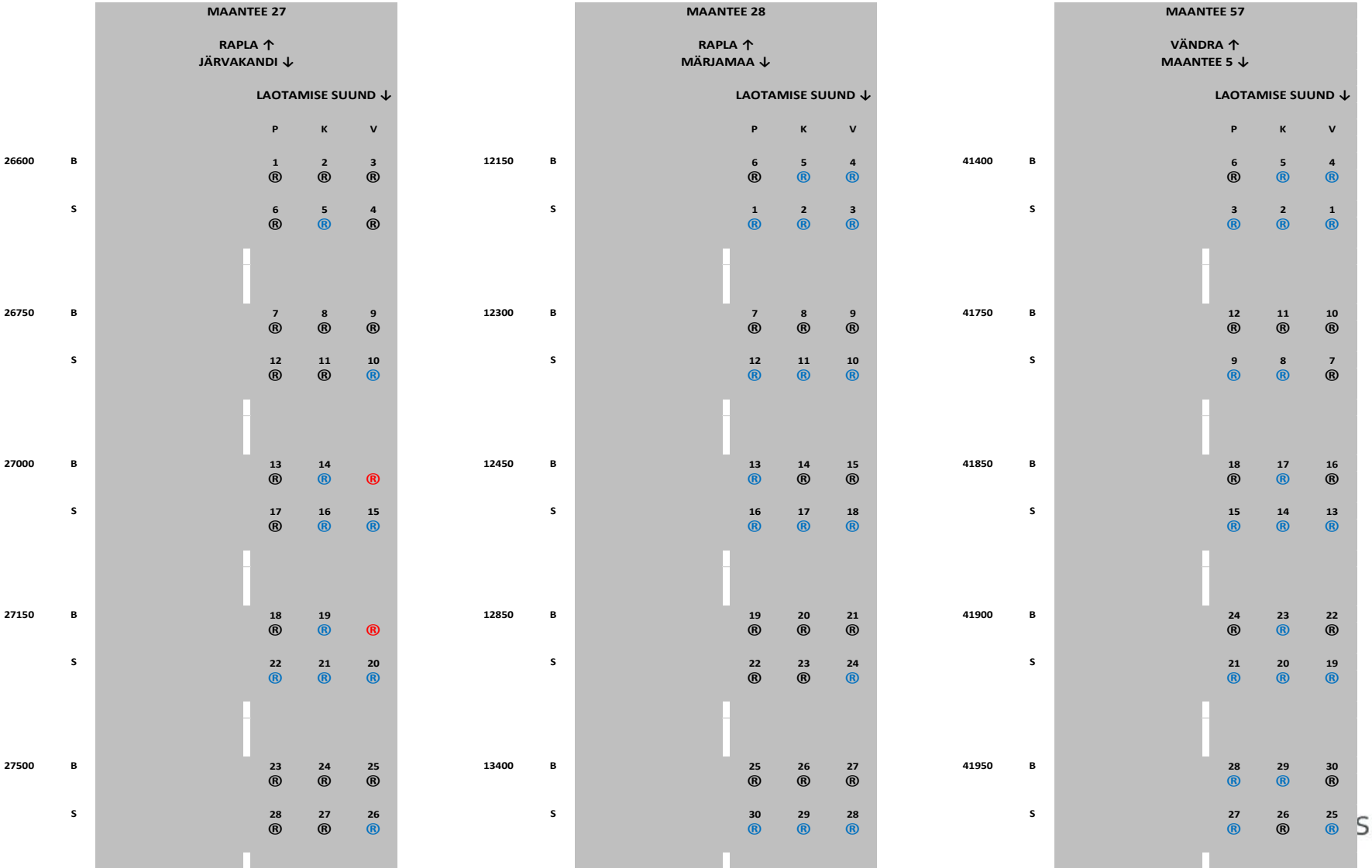
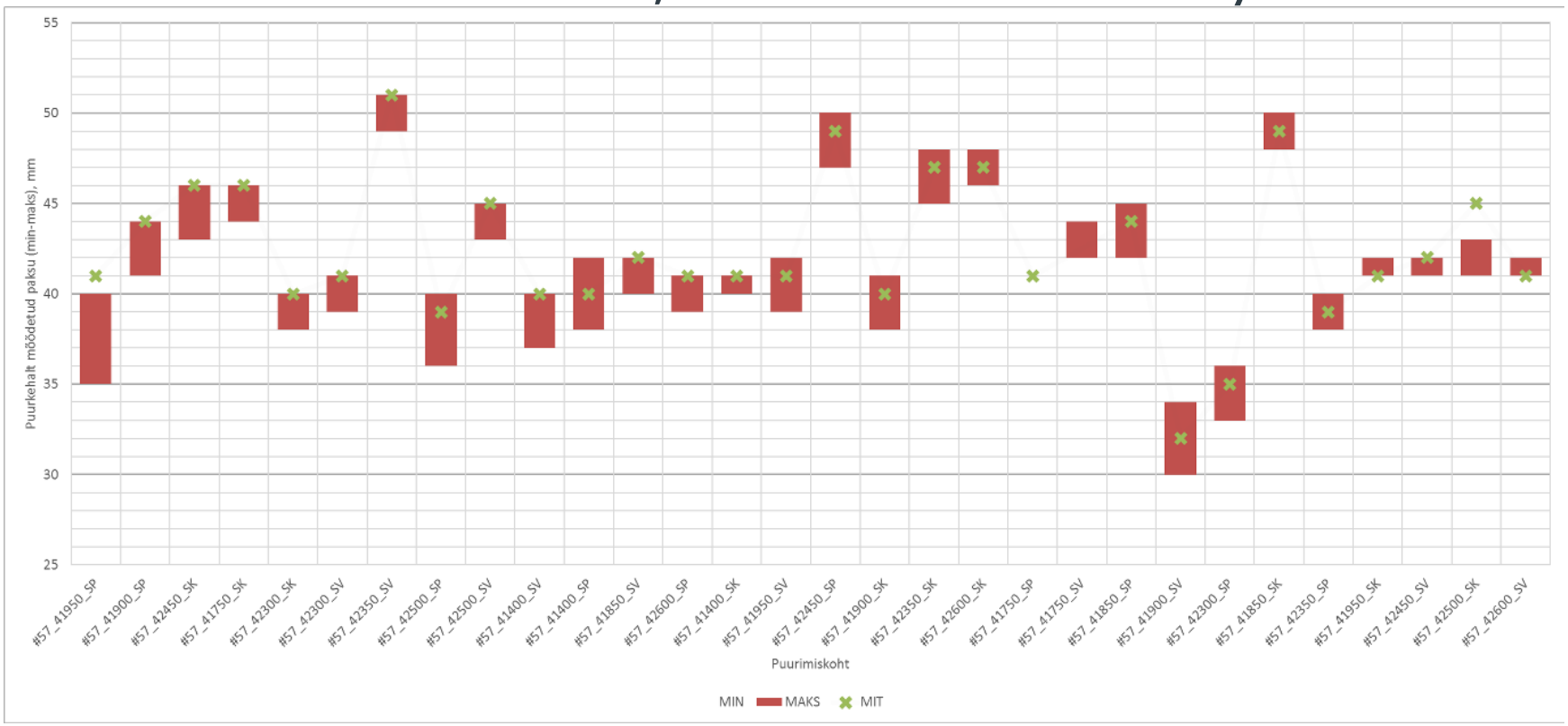
Coredrilling scheme



Comparison of MIT with cores

- Thickness of upper layer of each core was measured in site 1, full reflectors rarely found



MIN & MAX thickness of coresample

thickness with MIT

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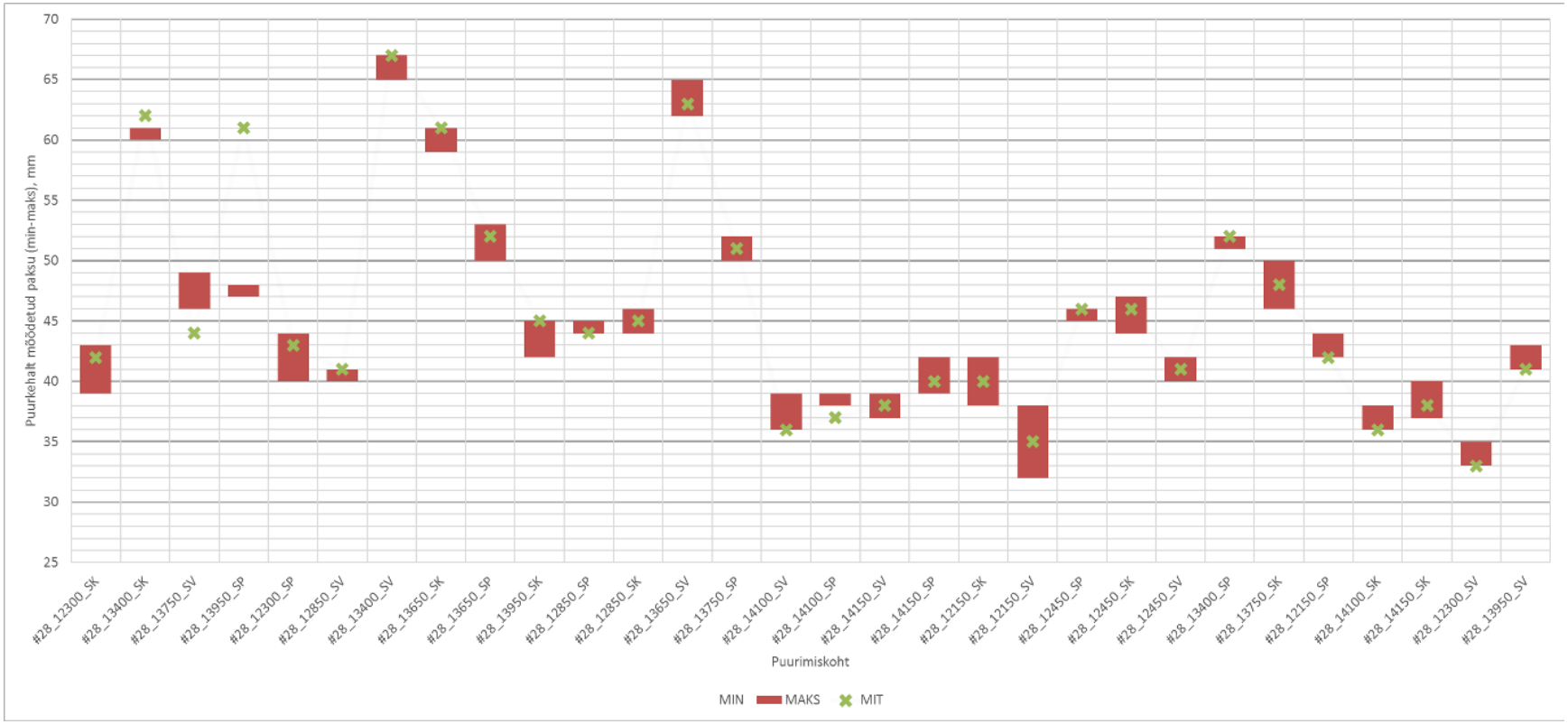
Comparison of MIT with cores

- Thickness of upper layer of each core was measured in site 2, full reflectors rarely found



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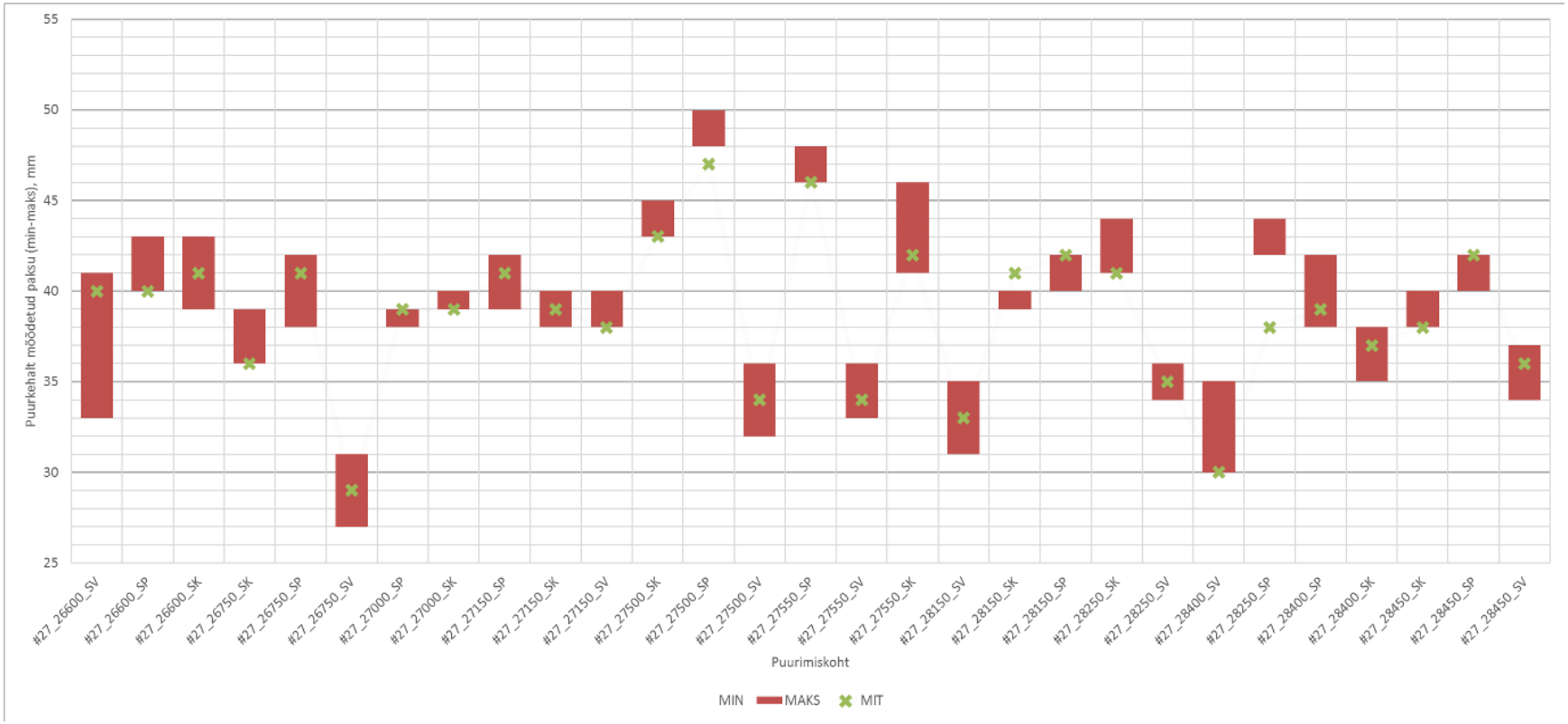
Comparison of MIT with cores

- Thickness of upper layer of each core was measured in site 3, full reflectors rarely found



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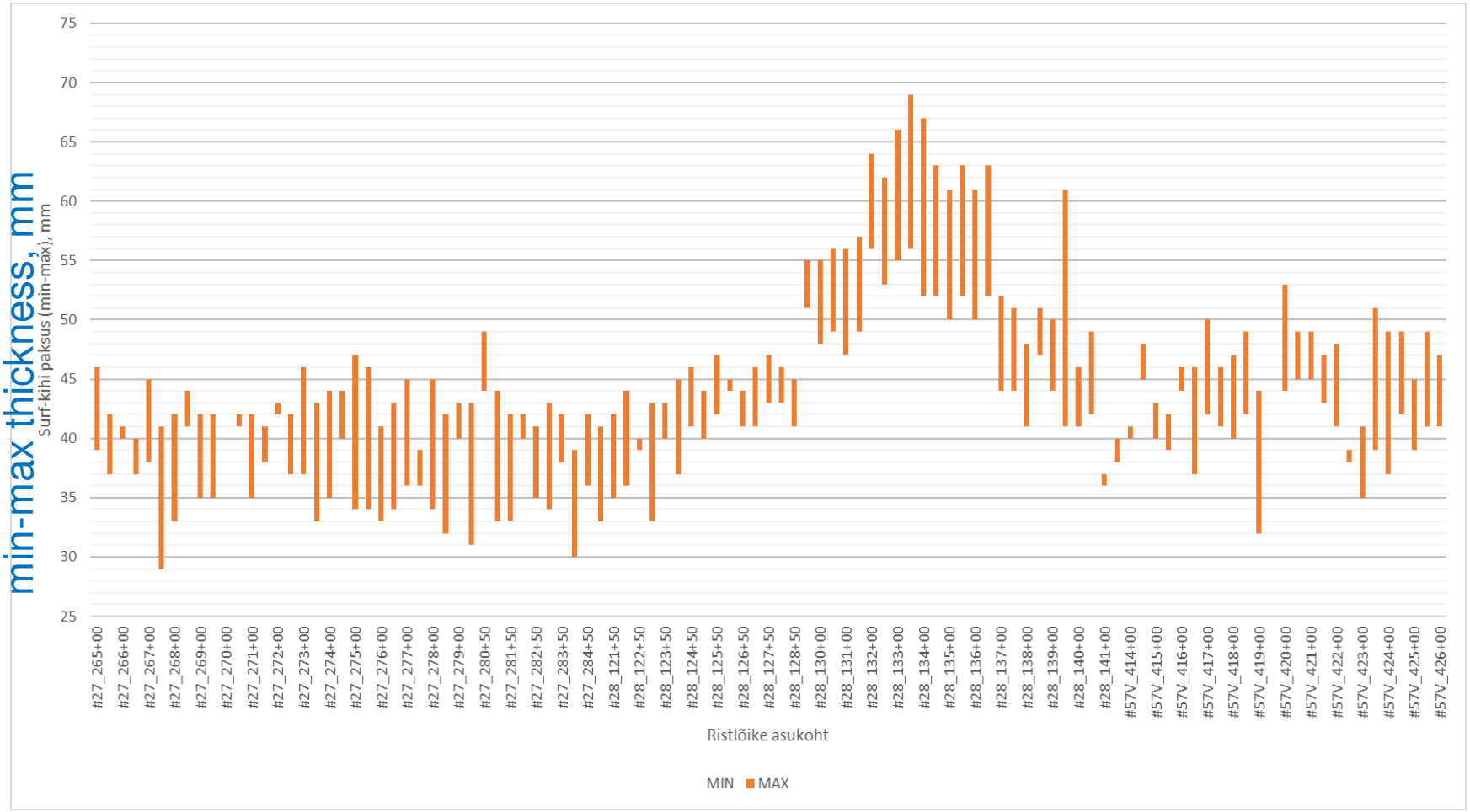
Thickness variances in cross-section with MIT (surf)



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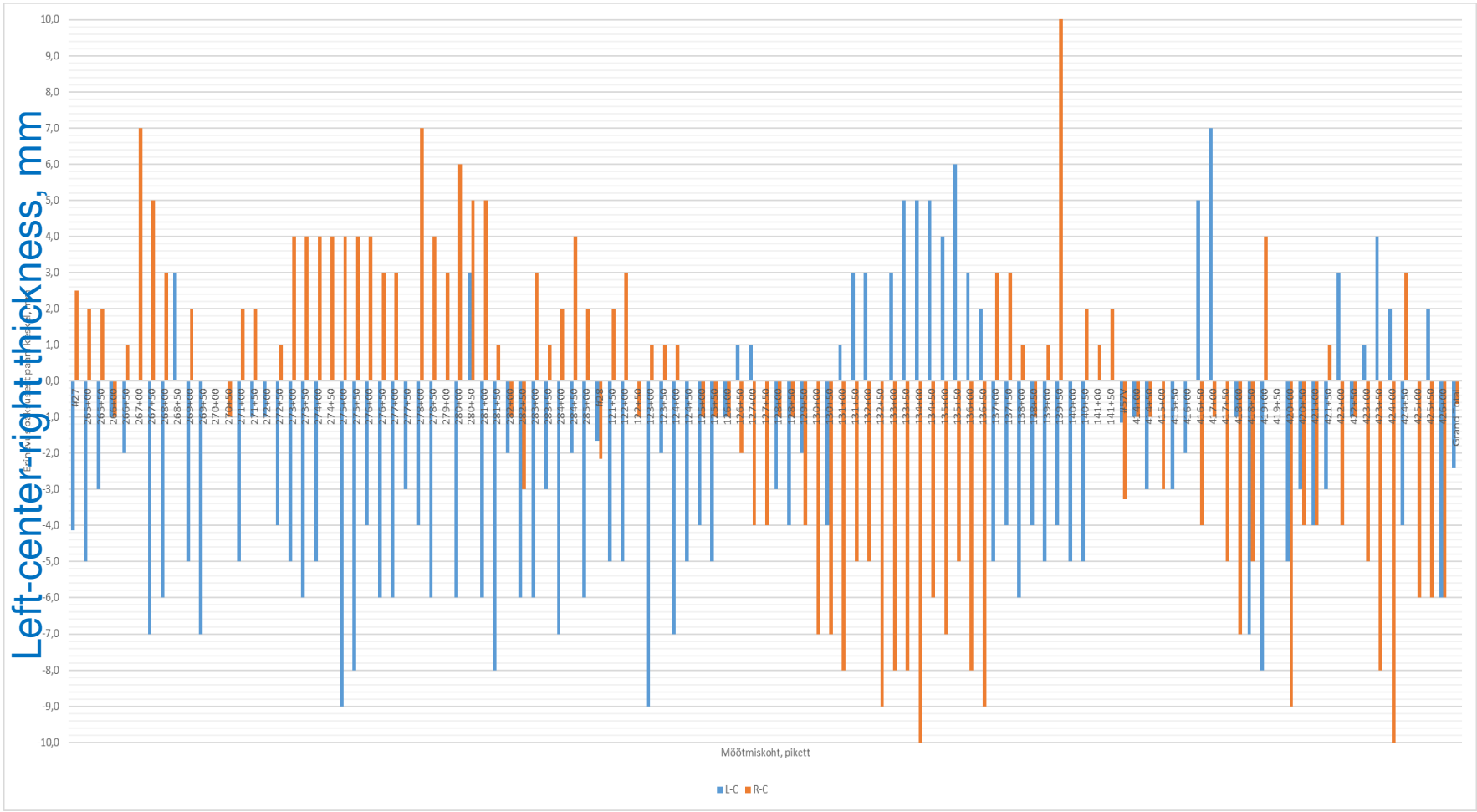
Thickness variances in cross-section with MIT (surf)



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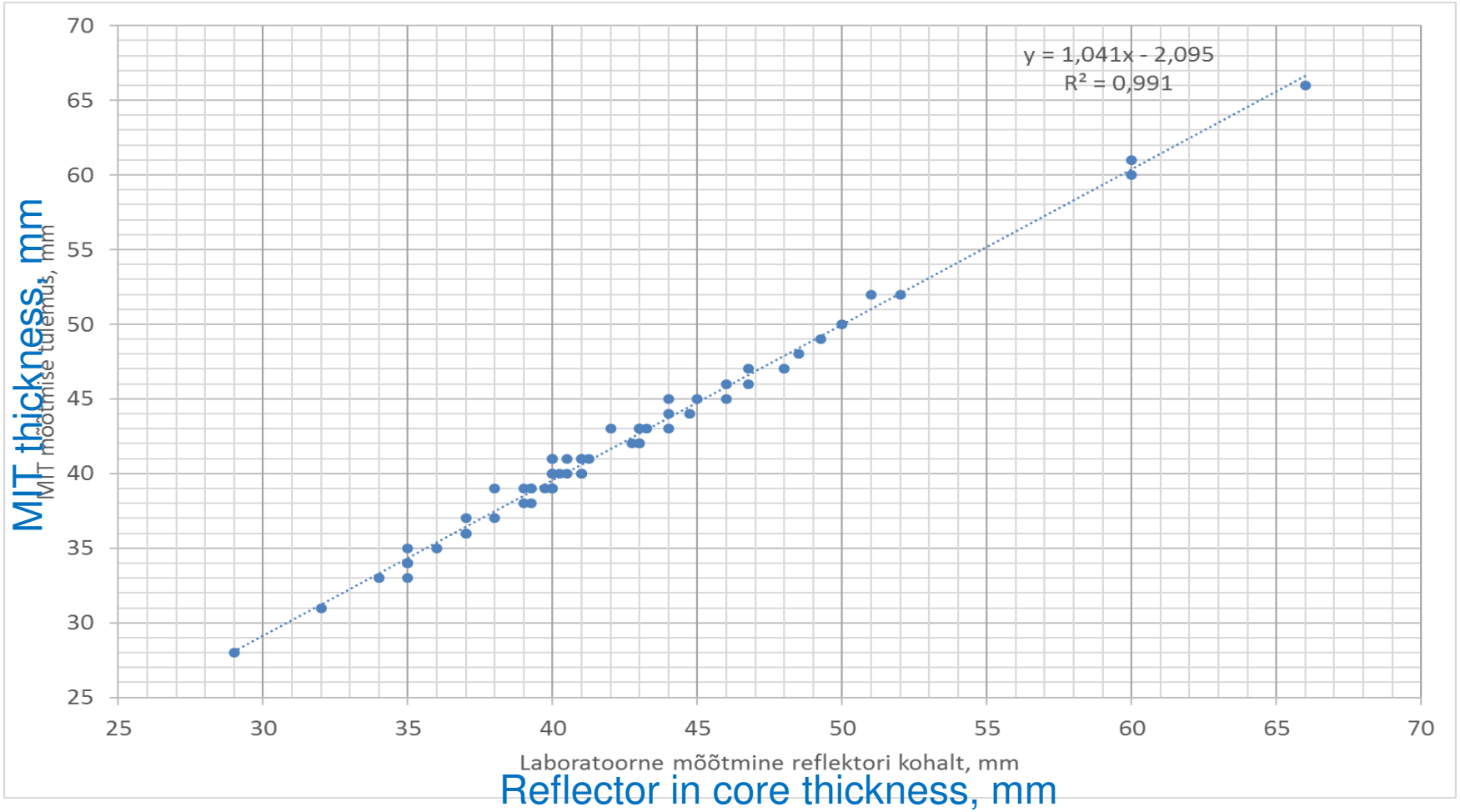
Important finding

- It was found that in these 2 places where high difference (>2mm) between thicknesses from cores and those measured with MIT device ocurred, only tiny part of reflector was visible (>90% was outside the core).
- Therefore, these values were eliminated from final analysis for conclusions

Correlation MIT vs cores with found reflector (surf)



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Advantages and disadvantages

	Advantages	Disadvantages
Ground Penetrating Radar	• Continuous measurement indicating the areas of insufficient thickness • Measurement is fast intraffic speed	• Not always possible for upper pavement layer alone • Needs calibration cores • Accurate calibration difficulties due to layer thickness variability
MIT - Eddy Currents in Reflectors	• Fast single measurements • No need for calibration cores	• Single measurement provides single result • Reflectors shall be placed before paving • For good coverage in length and width, ca 60 single measurements are needed per lane-km

Conclusions

- Based on literature review, **Ground Penetrating Radar** and technology based on measuring **Eddy Currents in Reflectors** (with MIT-SCAN) were selected for field tests
- There are advantages and disadvantages for both technologies, however guaranteed results in measuring upper layer thickness can be provided only through measuring **Eddy Currents in Reflectors**
- It is suggested to introduce technology of measuring **Eddy Currents in Reflectors** for reliably measure single layer thicknesses nondestructively, with same accuracy and lower cost per measurement (including reflector installation) compared to destructive coredrilling and with recovery option to check depth of reflector with coredrilling

Thank You!

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