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# Analysis of Pavement Conditions through Vehicle-Based Sensing

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## Homeland Security Challenge

Our team's challenge was focused on infrastructure analysis with emphasis to pavement conditions and the relationship between vertical acceleration vibration and pavement roughness. The primary objective of this study was to integrate a vehicle-based sensing system and a full car model to better predict pavement roughness, pavement condition classification and identify critical cracking locations.

## Methodology

Pavement analysis took place along two segments of the I-10 corridor from 27th Ave to 51st Ave & Baseline Rd to Chandler Blvd. A vehicle outfitted with five accelerometers which were used to collect vibration data; one on each control arm and one in the passenger cabin. The vibration data collected will be used to obtain correlations between the vertical responses each sensor registers to the International Roughness Index (IRI) data on record, provided by Arizona Department of Transportation (ADOT). Programming in Arcmap GIS through window interpolation method were performed for data selection and analysis. Through the process of data acquisition, data matching, selection, regression, and numerical modeling processes, a correlation between field responses and corresponding IRI were developed.

Figure 1

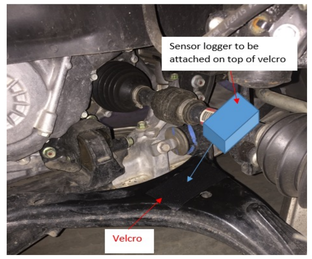
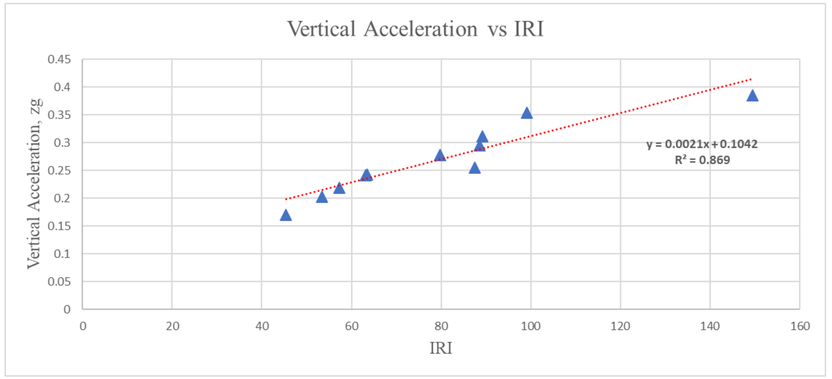



Figure 2

## Outcomes / Results

### North/South Bound – Baseline Rd to Chandler Blvd



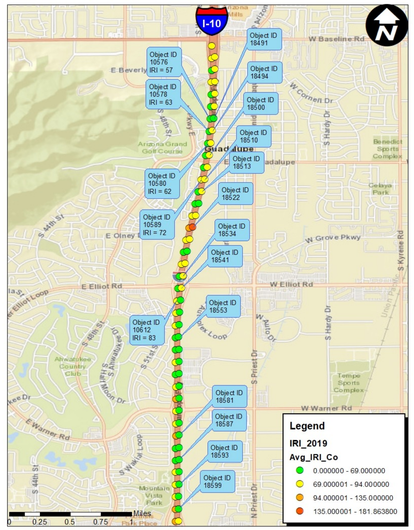
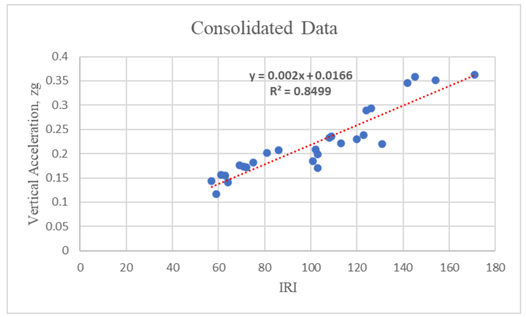




Figure 3




Combined Data of NB/SB & WB/EB Segments

## Conclusions

Our results yielded correlation with an explanation coefficient ($R^2$) of 0.86. The results show that the simulated pavement roughness obtained from the full car model was able to verify the field data. What we were looking for was to see direct relationships between the vertical acceleration ad IRI; high acceleration responses for poor IRI and low acceleration responses for good IRI. It was concluded that pavement roughness could be predicted utilizing integrated vehicle-based sensing and the full car model and is a promising method to assess pavement condition. In summary, an advanced pavement roughness assessment method using vehicle-based sensing was developed. The method may be used in a full car model for better pavement roughness prediction with applications for pavement maintenance scheduling, pavement rehabilitation and pavement preservation.

## References

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