



HORIZON 2020



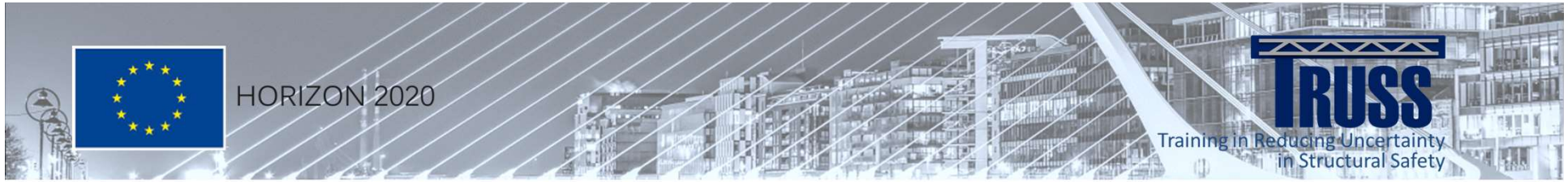
Training in Reducing Uncertainty
in Structural Safety

ESR₁₂: Daniel Martinez Otero



University College Dublin

Bridge Damage Detection using an
Instrumented Vehicle



Research

- The use of Instantaneous Curvature (IC) for bridge damage detection.
- The use of Rate of Instantaneous Curvature (RIC) for bridge damage detection.
- Bridge Stiffness Calculation using Random Traffic and Deflections.
- Bridge Stiffness Calculation from Rotations measured from an Instrumented Vehicle.



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Instantaneous Curvature (IC) for Bridge Damage Detection

$$\kappa_{healthy}(x) = \frac{M(x)}{EI}$$

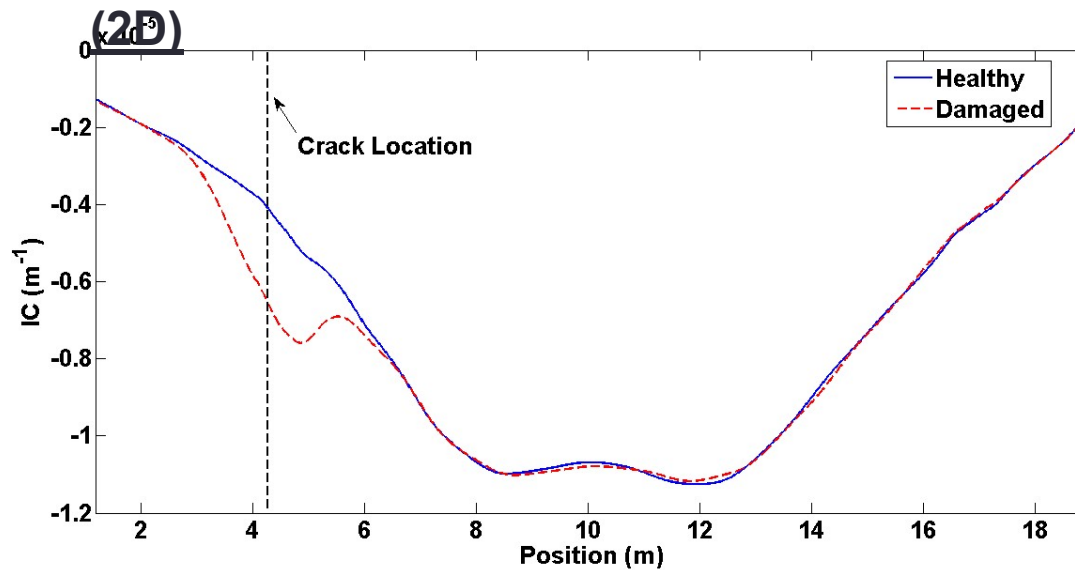
$$\kappa_{damaged}(x) = \frac{M(x)}{EI_{reduced}}$$

Instantaneous
Curvature (IC)



Moving reference
curvature

IC OF HEALTHY AND DAMAGED CASES (2D)



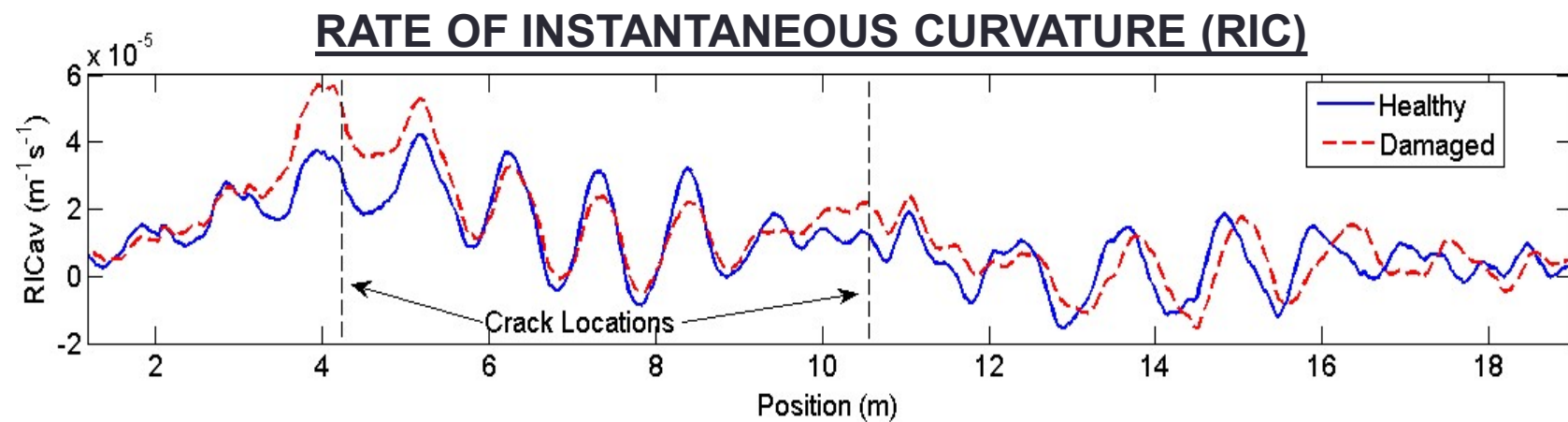


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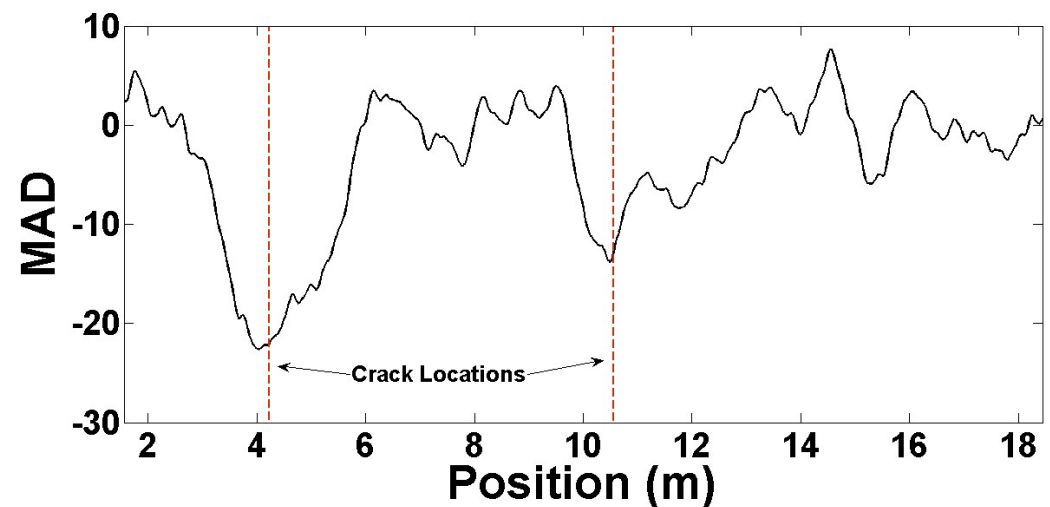
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Rate of Instantaneous Curvature (RIC) and Moving Average Difference (MAD)



MOVING AVERAGE DIFFERENCE (MAD)



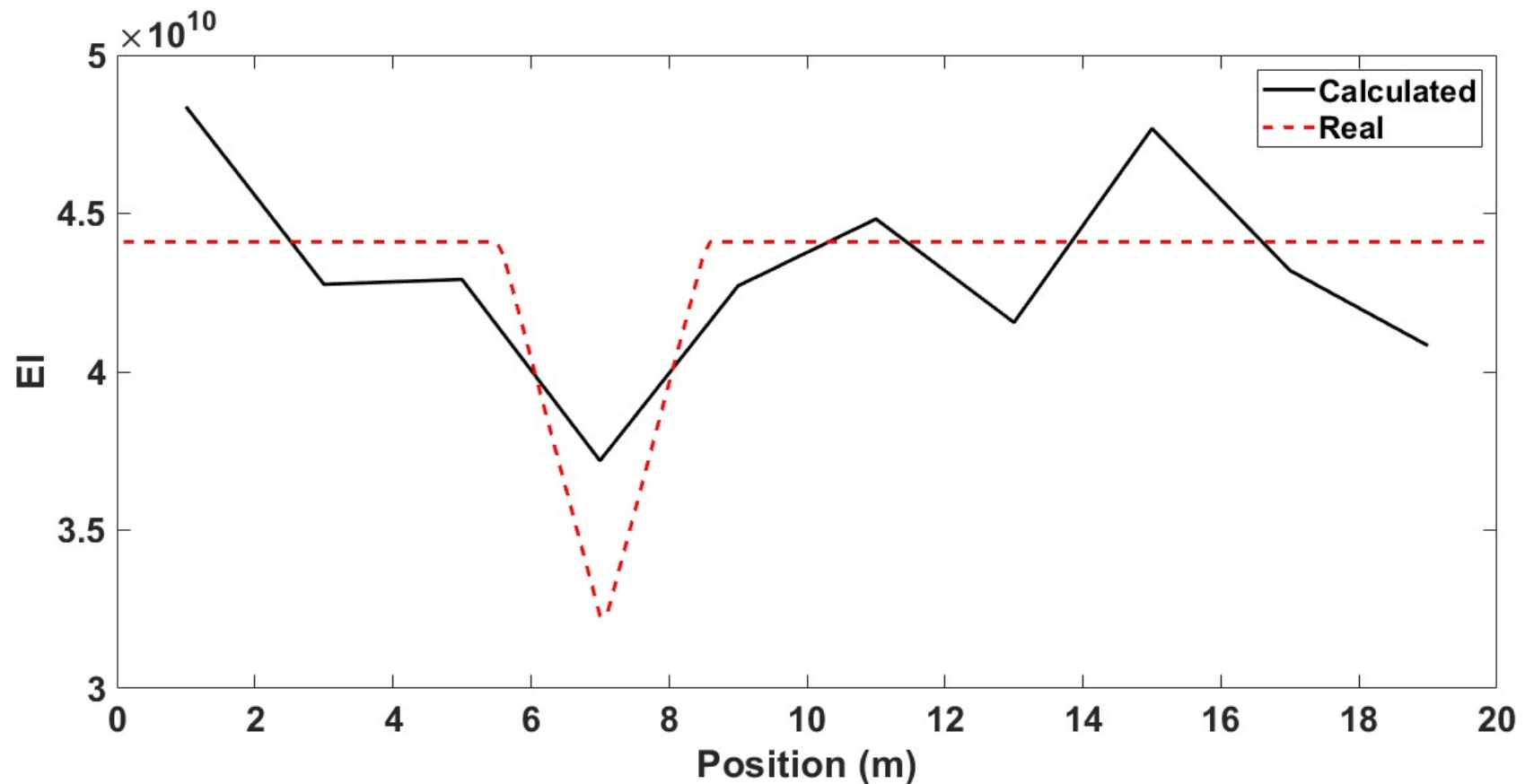


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Relative Stiffness Calculation using Random Traffic and Deflections





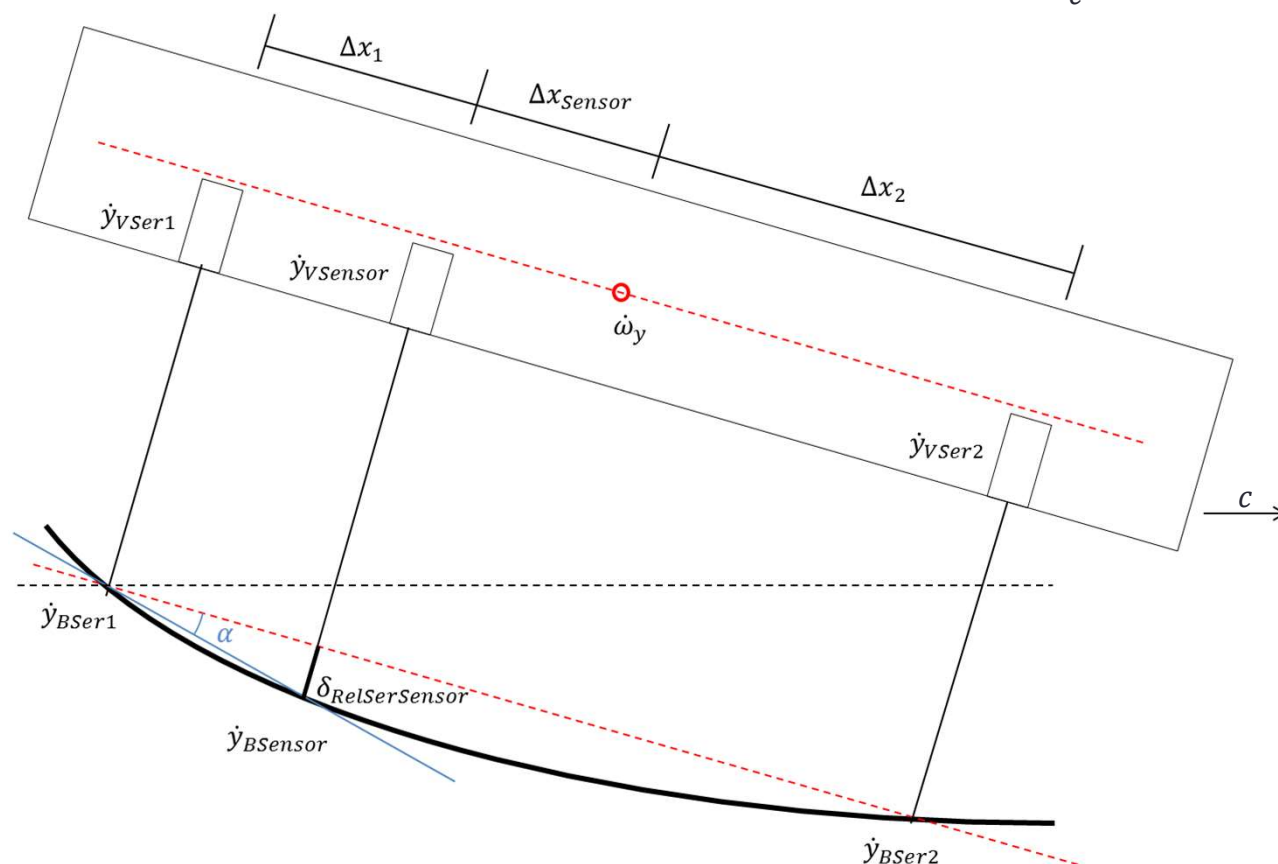
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Bridge Stiffness Calculation from Rotations measured from an Instrumented Vehicle.

$$\frac{(\dot{y}_{BSensor} - \dot{y}_{VSensor}) - (\dot{y}_{BSer1} - \dot{y}_{VSer1}) - (\Delta x_{Sensor} + \Delta x_1) \times \dot{\omega}_y}{c} = \alpha$$





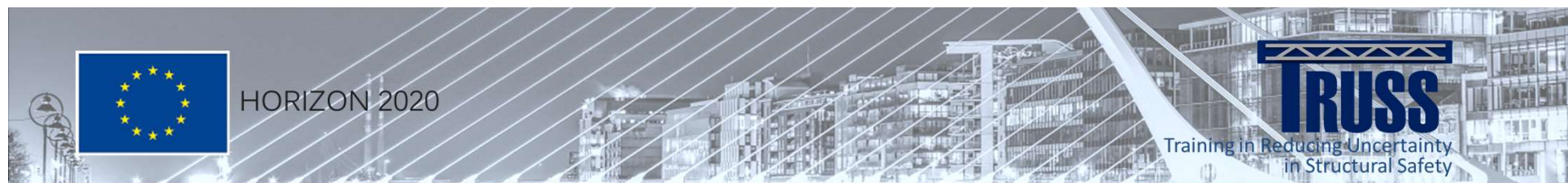
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Training

Type of Activity	Start date	End date	Title of course/conference/activity and location	No. hours
Secondment (Short Stay < 3 months)	29/09/15	01/10/15	Greenwood Engineering	
Course (>1 day)	14/10/15	29/04/16	Seminars on Research, UCD, Dublin, Ireland	15
Tutorial/Supervision/Den	25/01/16	05/06/16	Peer Assisted Tutoring, UCD, Dublin, Ireland	35
Language Course	01/02/16	26/04/16	Academic Written English, UCD, Dublin, Ireland	20
Seminar (<=1 day)	01/02/16	01/02/16	Endnote, UCD, Dublin, Ireland	1
Secondment (Short Stay < 3 months)	10/04/16	16/04/16	Greenwood Engineering	
Conference	31/05/16	31/05/16	CSHM-6, Queen's University, Belfast, UK	
Conference	29/08/16	30/08/16	CERI 2016, Galway, Ireland	
Conference	05/09/16	05/09/16	SEMC 2016, Cape Town, South Africa	
Secondment (Long Stay >= 3 months)	28/10/16	02/04/16	Greenwood Engineering	
Workshop	24/11/16	25/11/16	ROSE Green Roads Infrastructure	
Outreach(open day, talks)	10/11/15	10/11/15	Marshmallow Challenge Willow School	3
Outreach(open day, talks)	27/07/17	27/07/17	Wooden Bridge Challenge UCD	



Training

Type of Activity	Start date	End date	Title of course/conference/activity and location	No. hours
Conference	18/06/17	22/06/17	ESREL 2017, Portoroz, Slovenia	
Outreach(open day, talks)	13/11/17	13/11/17	Marshmallow Challenge Willow School 2	3
Seminar (<=1 day)	01/09/17	01/09/17	Simulation of hydraulic fracture networks in shale and Dislocation mechanism-based crystal plasticity at submicron scale	1
Other (specify)	01/08/17	31/10/17	TRA VISIONS Contest with the project name "Bridge Safety Assessment"	
Other (specify)	24/04/18		Peer Reviewer of JoSEM journal	
Other (specify)	12/06/18		Peer Reviewer of JoSEM journal	
Course (>1 day)	11/06/18	14/06/18	PM course in UCD	24
Seminar (<=1 day)	15/05/18		Reading for your thesis, UCD, Dublin	1
Seminar (<=1 day)	18/05/18		Writing Habits, UCD, Dublin	1
Seminar (<=1 day)	21/05/18		Writing solid academic essays, UCD, Dublin	1
Conference	18/04/18	31/08/18	Member of the Local Organizing committee of CERA12018 conference http://www.cerai.net/page/8/committees/	



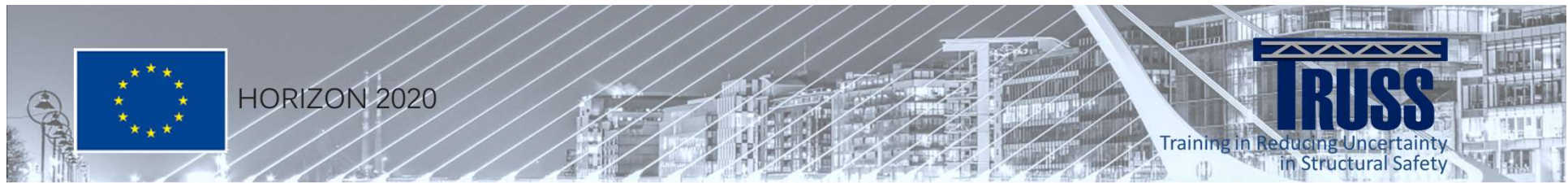
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Dissemination

Type of publication	Start date (only if conference)	End date	Title of Publication	Authors (in the same order as published)	Full ref.(name,location or volume, page nos.,year)
Conference publication	19/05/16	21/05/16	Monitoring the Condition of a Bridge using a Traffic Speed Deflectometer Vehicle Travelling at Highway Speed	OBrien, E.J., Sevillano, E. and Martinez, D.	3rd International Balkans Conference on Challenges of Civil Engineering, GBCCCE, Tirana, Albania
Conference publication	26/05/16	27/05/16	Instantaneous Curvature in Bridge Damage Detection	Sevillano, E.,OBrien, E.J., and Martinez, D.	6th Workshop on Civil Structural Health Monitoring, CSHM-6 Belfast, UK
Conference publication	29/08/16	30/08/16	Drive-by Bridge Damage Detection Using Curvatures in Uncertain Environments	Martinez, D., OBrien, E.J. and Sevillano, E.	Civil Engineering Research in Ireland, CERI 2016, Galway, Ireland
Conference publication	05/09/16	07/09/16	Damage Detection by Drive-by Monitoring Using the Vertical Displacements of a Bridge	Martinez, D., OBrien, E.J. and Sevillano, E.	6th International Conference on Structural Engineering, Mechanics and Computation, SEMC 2016, Cape Town, South Africa
Journal publication		10/07/17	Damage Detection Using Curvatures Obtained from Vehicle Measurements	OBrien E.J., Martinez, D., Malekjafarian, A. and Sevillano, E.	E. OBrien, D. Martinez, A. Malekjafarian, and E. Sevillano, "Damage detection using curvatures obtained from vehicle measurements," Journal of Civil Structural Health Monitoring, vol. 7, no. 3, pp. 333-341, 2017.
Conference publication	03/04/17	06/04/17	A New Damage Indicator for Drive	OBrien E.J., Martinez, D., Malekjafarian, A. and Pape, T.	25th Austroads Bridge Conference, ABC2017, Melbourne, Australia
Conference publication	18/06/17	22/06/17	Pavement Condition Measurement	Malekjafarian, A., Martinez, D., OBrien E.J.	27th European Safety and Reliability Conference, ESREL 2017, Portoroz, SI

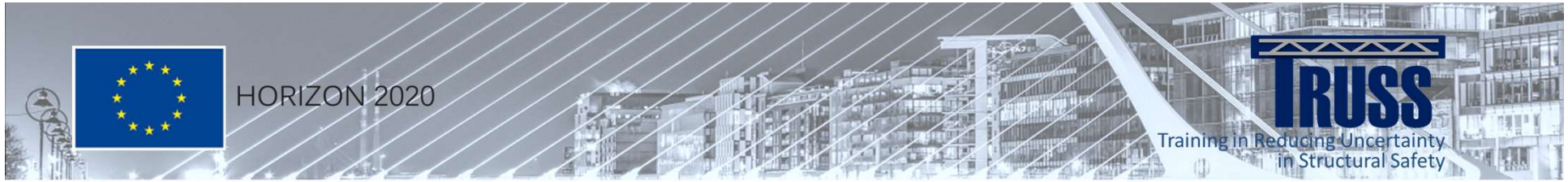


Dissemination

Type of publication	Start date (only if conference)	End date	Title of Publication	Authors (in the same order as published)	Full ref.(name,location or volume, page nos.,year)
Journal publication	17/05/18		Indirect Bridge Damage Detection Using Laser Measurements on a TSD	Malekjafarian, A., Martinez, D., OBrien E.J.	Abdollah Malekjafarian, Daniel Martinez, and Eugene J. OBrien, "The Feasibility of Indirect Bridge Damage Detection Using Laser Measurements on a TSD", <i>Journal of Bridge Engineering</i> , vol. 23, no. 5, pp. 05018001, 2018.
Conference publication	05/12/17	08/12/17	Structural Health Monitoring Development and Application	Gonzalez, A., Huseynov, F., Heitner, B., Vagnoli, M., Moughty, J.J., Barrias, A., Martinez, D., Chen, S., OBrien, E.J., Laefer, D., Casas, J.R., Remenyte-Priscott, R., Yalamas, T., Brownjohn, J.	Structural Health Monitoring in Real-world Application, Queensland University of Technology, Australia, 2017.

Dissemination

Type of publication	Start date (only if conference)	End date	Title of Publication	Authors (in the same order as published)	Full ref.(name,location or volume, page nos.,year)
Conference publication	09/07/18	13/07/18	TRUSS-ITN methods for detecting	Gonzalez, A., Martinez, D., O'Brien, E.J., Casero, M., Moughty, J.J., Casas, J.R., Vagnoli, M., RemenYTE-Prescott, R., Andrews, J., Huseynov, F., Brownjohn, J.	9th INTERNATIONAL CONFERENCE ON BRIDGE MAINTENANCE, SAFE1
Conference publication	28/10/18	31/10/18	Bridge Condition Evaluation using	Martinez, D., Malekjafarian, A., O'Brien, E.J.,	The Sixth International Symposium on Life-Cycle Civil Engineering IALCEE,
Other publication	31/07/18	03/08/18	Bridge Health Monitoring Using Ac	Khan, M.A., O'Brien, E.J., Martinez, D.	10th INTERNATIONAL CONFERENCE ON SHORT AND MEDIUM SPAN BI
Conference publication	30/08/18	31/08/18	Sensitivity of SHM Sensors to Brid	Martinez, D., O'Brien, E.J., Malekjafarian, A., Mohammed, Y.M., Uddin, N.	Civil Engineering Research in Ireland, CERI 2018, Dublin, Ireland



Outreach

Marshmallow Challenge in Willow School 1 (10/11/2015)

Wooden Bridge Challenge (27/07/2015)

Outreach

Marshmallow Challenge in Willow School 2 (13/11/2017)

