“THE IMPACT OF PASSIVE AIR POLLUTION MITIGATION MEASURES IN THE BUILT ENVIRONMENT”

ASST. PROF. JOHN GALLAGHER

EMAIL: J.GALLAGHER@TCD.IE

TWITTER: @EnvDrJohnG
THE IMPACT OF PASSIVE AIR POLLUTION MITIGATION MEASURES IN THE BUILT ENVIRONMENT

PRESENTATION OVERVIEW

MY WORK IN THIS FIELD – PAST AND PRESENT

MY APPROACH TO PASSIVE AIR POLLUTION MITIGATION

WHO ARE WE AS A RESEARCH COMMUNITY?

TAKE HOME MESSAGES
THE IMPACT OF PASSIVE AIR POLLUTION MITIGATION MEASURES IN THE BUILT ENVIRONMENT

MY WORK IN THIS FIELD – PAST AND PRESENT

ASST. PROF. JOHN GALLAGHER
TRINITY COLLEGE DUBLIN, IRELAND

WEB: WWW.TCD.IE/CIVILENG/PEOPLE/JGALLAG9/
The impact of passive air pollution mitigation measures in the built environment

My work in this field – past and present

**Low boundary walls**

Influence on air flow and pollutant dispersion on personal exposure.

**Interactions between urban morphology and local meteorology.**

Computational fluid dynamic (CFD) is a useful assessment tool, but time and experience is required.

Gallagher et al., 2011; 2012; 2013
Simplifying the complex...

<table>
<thead>
<tr>
<th>Wind Direction</th>
<th>90°</th>
<th>0°</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Speed (m/s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Leeward</td>
<td>Windward</td>
<td>Mean</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Solid barriers have been shown to **improve local air quality** on the footpaths for pedestrians in **specific conditions**.

Percentage difference of reference model to footpath and central LBW models for a high (8 m/s) wind speed in a perpendicular direction to street canyon:

<table>
<thead>
<tr>
<th>$H_1/H_2$ Ratio</th>
<th>Footpath LBWs</th>
<th>Central LBW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.76 m</td>
<td>1.00 m</td>
</tr>
<tr>
<td>LW</td>
<td>WW</td>
<td>WW</td>
</tr>
<tr>
<td>0.5</td>
<td>17%</td>
<td>40%</td>
</tr>
<tr>
<td>1.0</td>
<td>-14%</td>
<td>37%</td>
</tr>
<tr>
<td>1.5</td>
<td>3%</td>
<td>48%</td>
</tr>
</tbody>
</table>

Gallagher et al., 2011; 2012; 2013; 2015
THE IMPACT OF PASSIVE AIR POLLUTION MITIGATION MEASURES IN THE BUILT ENVIRONMENT

MY WORK IN THIS FIELD – PAST AND PRESENT

iSCAPE (IMPROVING THE SMART CONTROL OF AIR POLLUTION IN EUROPE)

IMPLEMENT REAL-WORLD PHYSICAL INTERVENTIONS (PASSIVE CONTROL SYSTEMS) ACROSS EUROPE.

QUANTIFY THE POTENTIAL OF PCS IN DIFFERENT CLIMATIC CONDITIONS.

DEVELOP TECHNICAL GUIDANCE FOR PCS IMPLEMENTATION.

CO-DEVELOP POLICY DOCUMENTS TO ENSURE PCS IS PART OF FUTURE URBAN PLANNING STRATEGIES.

www.iSCAPEproject.eu
@iSCAPEproject

Abhijith et al., 2017
THE IMPACT OF PASSIVE AIR POLLUTION MITIGATION MEASURES IN THE BUILT ENVIRONMENT

MY WORK IN THIS FIELD – PAST AND PRESENT

**LIFE CYCLE COSTS OF DIFFERENT MEASURES – INSTALLATION VS OPERATIONAL COSTS/IMPACTS.**

<table>
<thead>
<tr>
<th>Mitigation Strategy</th>
<th>NO₂ Concentrations on Footpaths (Pedestrian Exposure)</th>
<th>NO₂ Concentration on the Road (Cyclist/Driver Exposure)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing tree</td>
<td>✔️ 0.9 % decrease</td>
<td>✔️ 2.0 % decrease</td>
</tr>
<tr>
<td>Narrow tree</td>
<td>✗ 1.0 % increase</td>
<td>✗ 0.3 % increase</td>
</tr>
<tr>
<td>Painted buildings (NO₂)</td>
<td>✔️ 0.8 % decrease</td>
<td>✔️ 0.4 % decrease</td>
</tr>
<tr>
<td>Solid barrier</td>
<td>✔️ 4.4 % decrease</td>
<td>✔️ 38.3 % increase</td>
</tr>
<tr>
<td>Painted barrier (NO₂)</td>
<td>✔️ 6.5 % decrease</td>
<td>✔️ 36.1 % increase</td>
</tr>
<tr>
<td>Innovative barrier</td>
<td>✔️ 11.7 % decrease</td>
<td>✔️ 30.6 % increase</td>
</tr>
</tbody>
</table>

**IMPORTANCE OF MICRO-DETAILING FOR STREET-LEVEL GEOMETRY IN MODELLING.**

_Is a ‘Barrier’ a Good Thing?_

Jeanjean et al., 2017; Gallagher et al., 2019
THE IMPACT OF PASSIVE AIR POLLUTION MITIGATION MEASURES IN THE BUILT ENVIRONMENT
MY WORK IN THIS FIELD – PAST AND PRESENT

ALTERNATIVE PASSIVE AIR POLLUTION MITIGATIONS MEASURES, THOSE HIDDEN IN PLAIN SIGHT?!
THE IMPACT OF PASSIVE AIR POLLUTION MITIGATION MEASURES IN THE BUILT ENVIRONMENT

MOVING FORWARD - MY APPROACH TO PASSIVE AIR POLLUTION MITIGATION

WHAT DO YOU SEE?

A LIVING, BREATHING PLANT

A NATURAL HABITAT

A PHYSICAL OBJECT

AN ENGINEERING SOLUTION

AN INTRUSIVE ENTITY

OTHER…
THE IMPACT OF PASSIVE AIR POLLUTION MITIGATION MEASURES IN THE BUILT ENVIRONMENT

MOVING FORWARD - MY APPROACH TO PASSIVE AIR POLLUTION MITIGATION

A PLATFORM FOR SHARED KNOWLEDGE AND BEST PRACTICE THE GOES BEYOND THIS RESEARCH COMMUNITY.

CREATING EFFECTIVE AIR POLLUTION MITIGATION MEASURES E.G. ‘GREEN’ SPACES.

BALANCING LIFE CYCLE IMPACTS OF PASSIVE MEASURES (E.G. AIR VS URBAN HEAT ISLAND)

CONSIDER THE EFFECT OF PASSIVE AIR POLLUTION MITIGATION ON OUTDOOR-INDOOR INTERACTIONS.
THE IMPACT OF PASSIVE AIR POLLUTION MITIGATION MEASURES IN THE BUILT ENVIRONMENT

WHO ARE WE AS A RESEARCH COMMUNITY

Q2. Who are you, and what can you bring to this community?

• Engineer
• Scientist
• Architect
• Urban planner
• Policy-maker
• Environmentalist
• Just interested
• Other...

Q3. What are you specifically interested in?

• Solid barriers
• Green infrastructure (trees & hedges)
• Green infrastructure (walls & roofs)
• Urban design
• Overall passive mitigation
• Other
Q4. **What do you bring to the table?**

- Research (technical)
- Research (environmental)
- Research (economic)
- Technical guidance
- Policy pathway
- Financial support
- Co-benefit expertise
- Other...

Q5. **What are your priorities from this webinar (and the series)?**

- Learn more about passive air pollution mitigation
- Support for implementing air pollution mitigation measures
- Transfer my research into practical guidance or influence policy
- Generate new research ideas – gaps in knowledge
- Other...
To address the challenge of air pollution, we must also consider the consequence(s) of implementing change e.g. passive air pollution measures.

Technical guidance and policy supports are needed, and the multiple benefits of some air pollution mitigation measures must be quantified - environmentally and economically.

As a community, promoting a sharing philosophy can speed up the translation of research to practice.
REFERENCES


