# ClearVision

Introduction to Visual Pollution Smart Inspection Models

Riyadh | April 2022

# ClearVision team developed a case-clustering engine to identify duplicate, repeatedly reported visual pollution cases on the CRM

## Current challenges

### Unstructured public reports

– High # of reports (e.g., via Snap & Send)
– No limit in # of reports for same incident

Example report 1

Example report 2

### No clear prioritization of cases

– Limited availability of data / criteria to determine case priority

### Limited ability to identify violator

– Current visual pollution cases do not provide insights on recurrence of incident

## Case-clustering engine

**Based on AI / ML models**

✓ **Automatically creates unique, "virtual" cases**
Identifies clusters leveraging k-means and binary search algorithms

✓ **Scalable to any Visual Pollution case**
Pending validation of business rules (e.g., maximum distance between reports)

**Actionable insights**
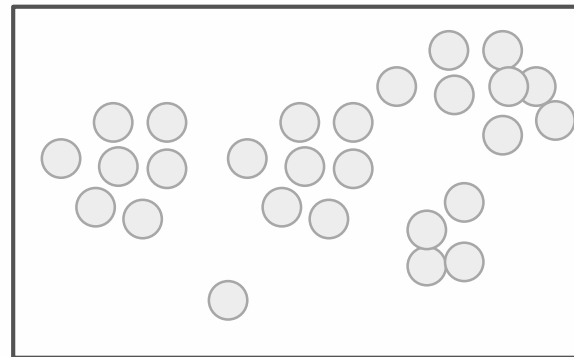
✓ **Provides visibility of each case's "impact"**
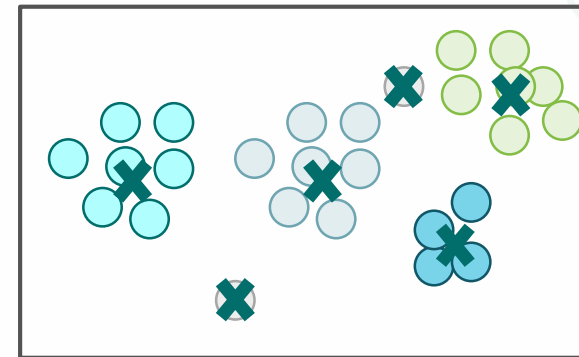Highlights incidents with high number of reports

✓ **Enables identification of original incident**
Thus, highlighting root cause of recurrent issues

*Illustrative example*

**27 un-clustered cases**

**6 clustered cases**

✓ **Clustering successful in 90%+ of cases**

Tested across 400 streetlight cases in October 2021

✕ Unique case (center)

# **Case clustering** in savings in case management time & effort, while highlighting where citizens are most engaged

**Output from clustering open visual pollution cases in Madinah as of 3 March 2022 (5 visual pollution categories)**
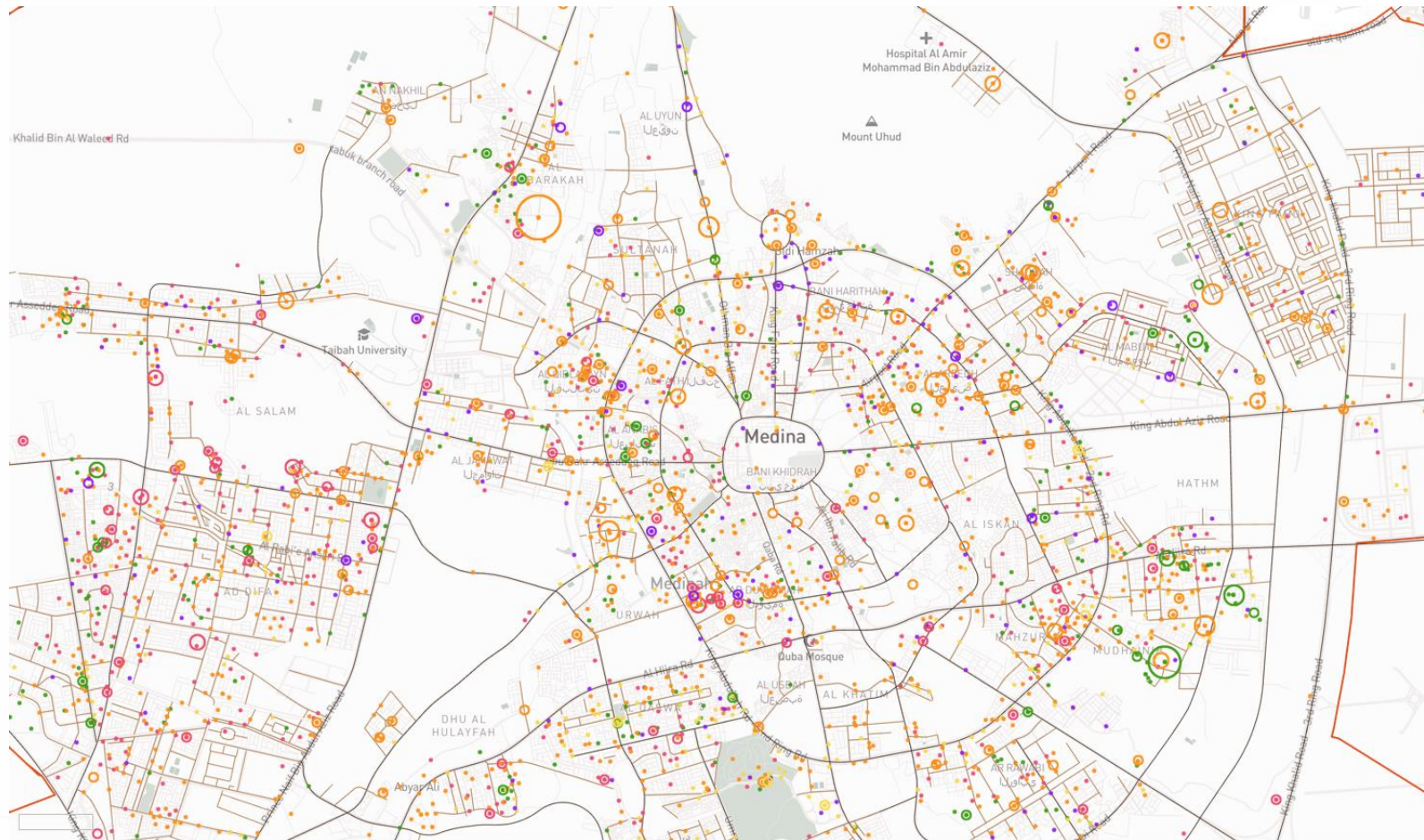


- 🟣 Excavation barriers
- 🔴 General cleaning
- 🟠 Potholes
- 🟡 Sidewalks
- 🟢 Streetlights

# In addition, a case prioritization engine was developed to guide municipal inspectors to tackle the highest priority CRM cases first

## Current challenges

### No prioritization for CRM cases limits impact of inspections

**Randomized case assignment**

– Inspector case assignment is "random"
– Cases usually allocated on a FIFO[1] basis
– No consideration for case type
– Static assignment of gravity or impact (based on classification)

**Reduced public perception**

– Cases with higher public visibility and / or posing more danger to the public may be deprioritized, causing **negative public perception** for municipal inspectors

## Prioritization engine

### The case prioritization engine will help inspectors identify priority cases to address first

**Example risk features (input)**

✓ **Number of duplicate case occurrences**
indicating urgency/risk

✓ **Business & Health Criticality index**
capturing overall threat to business & public health

✓ **Presence of contractors with VP priors**
Based on CRM link to historical excv. & constr.

✓ **# of Points of Interest in area**
Index of Points of Interest in area vs. average

✓ **Population concentration score**
Index of population in area vs. avg.

✓ **Additional features / hypotheses**
Based on VP category

**Example case priority (output)**
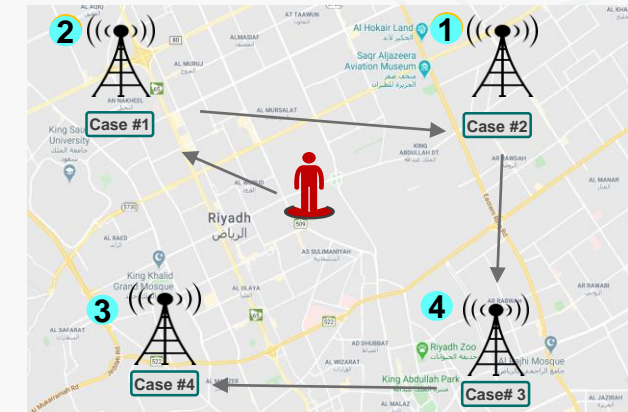


| Case #1 | 2m excavation width, 35K residents exposed, license associated with repeat violator |
| Case #2 | No excavation permit, 10k residents exposed, high priority area, in proximity of POIs |
| Case #3 | Construction waste in inappropriate location, residential area, 5 complaints lodged |
| Case #4 | No security fence around excavation, potential for damage due to high traffic density |

1. "First In, First Out"

# The **case prioritization** engine enables municipal supervisors to improve perception by dispatching inspectors to most visible and impactful cases

**Case prioritization engine out for open general cleaning cases in Madinah as of 3 March 2022**



Low priority score      High priority score
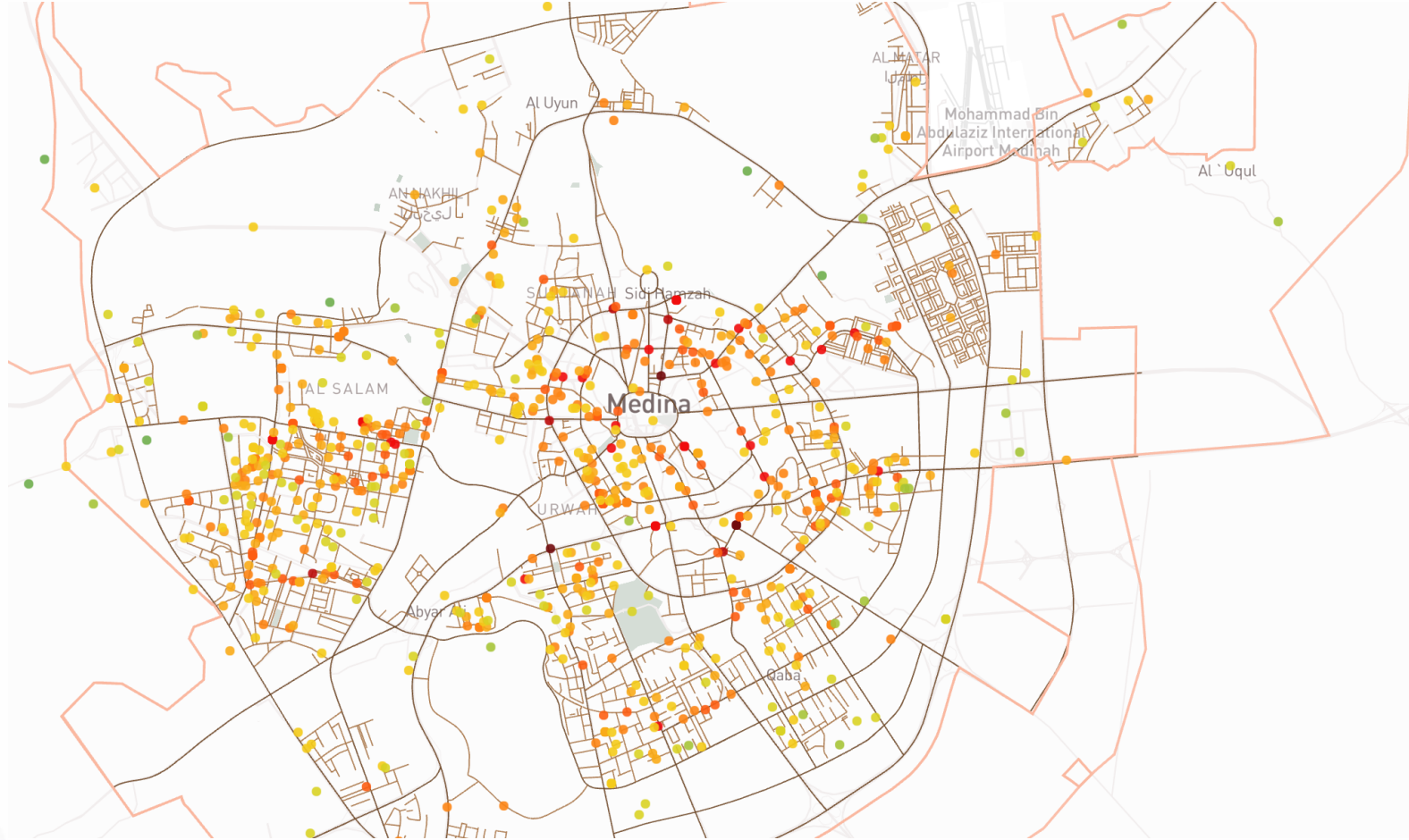
# To make a step change in visual pollution inspection outcomes, ClearVision team developed a risk-based engine to maximize inspection coverage

## Current challenges

### No clarity on how to identify and organize assets for inspection

**License vs. asset inspection**

– Current inspection types rely on licenses (e.g., retail) with defined visit frequency
– VP inspection can only rely on areas and assets

**Vast geographical coverage**

– 50,000 KM urban area
– 300,000+ KM of streets

**No guidance method**

– Current crowdsourced inspection does not include a guidance method
– Requires inefficient "static" scanning of all areas

## Risk-based "dispatching" engine

### The risk-based dispatching engine will provide a "block-by-block risk-assessment" of KSA

**Example risk features (input)**

✓ **VP case occurrences vs. average occurrence %**
Historical CRM case index score of area vs. avg.

✓ **# of active excavations / construction**
Index of excavation / construction work in area

✓ **Type of location**
Residential / Commercial / Industrial per priority

✓ **# of Points of Interest in area**
Index of Points of Interest in area vs. average

✓ **Population concentration score**
Index of population in area vs. avg.

✓ **Occurrence of traffic and / or accident**
Based on Google / Ookla or any additional sources

✓ **Additional features / hypotheses**
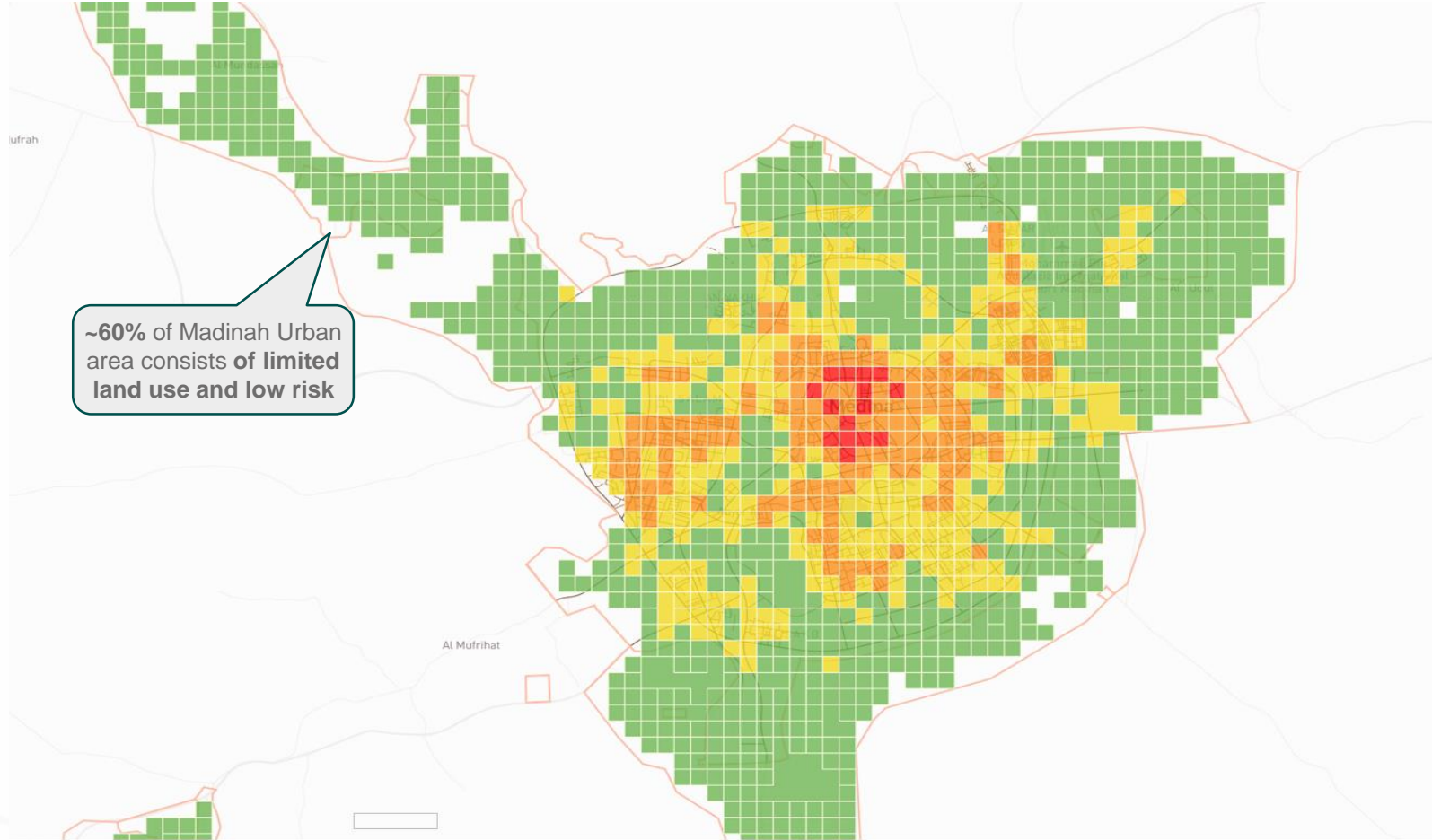Based on VP category

**Example risk assessment (output)**
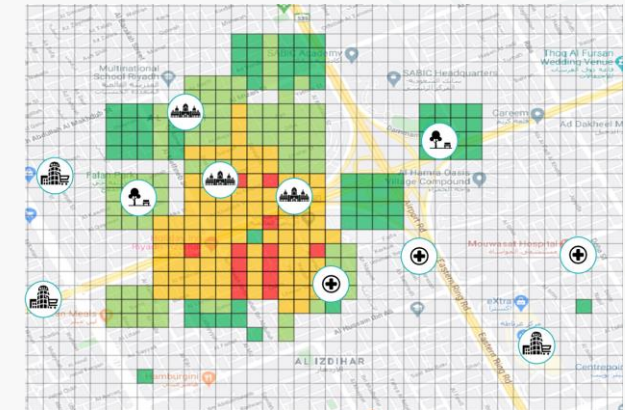


VP risk occurrence level
Low — High

✓ **Guide inspectors to highest-risk areas**
Where inspection may be most beneficial

✓ **Provide rationale behind area risk**
Explaining what inspectors should look out for

6

# To preempt visual pollution issues, the **risk-based dispatching engine** can help Madinah efficiently dispatch inspectors to maximize impact

**Risk-based dispatching engine output for general cleaning in Madinah urban area as of 23 February 2022**



~**60%** of Madinah Urban area consists **of limited land use and low risk**

Low risk score (0% – 10%)    Medium risk score (10% – 30%)    High risk score (30% – 70%)    Very high-risk score (70% – 100%)

Thank you