



Safety Codes Inspections Efficiencies Project (SCIE)

March 27, 2019

Project Update

After a lot of research and testing, we are ready to share which non-mandatory inspections we are moving forward with to determine risk level setting for October 2019 implementation. The four inspection types are:

- **Plumbing Ground non-mandatory inspections**
- **Plumbing Stack non-mandatory inspections**
- **HVAC: Stack non-mandatory inspections**
- **HVAC: Concealed Duct non-mandatory inspections**

Project Background

You're probably aware that we have been working on making the Safety Codes Inspections more efficient. Our primary goal is to have inspectors spend more time on mandatory inspections and less time on non-mandatory inspections. Doing this must not impact the safety of building systems and does not let builders get away with unsafe building practices. When inspectors spend less time on non-mandatory inspections, it frees up their time to focus on the mandatory ones and this leads to more happy builders in our city. Many other municipalities including Calgary and Sherwood Park are not conducting non-mandatory inspections. In many cases, Edmonton is the only municipality that continues to do all the non-mandatory inspections. The SCIE project will help us align with what others are doing in the province.

After much research and testing and many conversations with inspectors and industry stakeholders we decided to implement a technology solution to help us achieve our goal. We tested a similar idea on the Footing and Foundation project in 2018. The Quality Management Plan requires that foundation, framing and insulation and vapour barrier be conducted before the mandatory final inspection and traditionally, Safety Codes Inspectors have conducted all three inspections prior to the final inspection. We did an analysis of all building inspection data from the past 10 years. This showed that builders pass their footing and foundation inspection on the first inspection over 90% of the time. The footing and foundation inspection was chosen to be the first inspection type added to the risk-based inspection strategy because it has a low risk to public safety and a low risk of failure. To date, the project has been very successful and the ongoing checks and balances are producing great results.

About the Predictive Model

The Safety Codes Inspections Project uses the same idea but with a slightly different model. This model has learned from 600,000 real life examples and we can test the different types of inspections to see if it can predict pass or fail as well as a real life inspection. We have been reviewing the approximate 42,000 inspection results from 2017 and 2018 to see when the inspectors decision matched or differed from the models result. Using this information, we are looking closer at four inspections for implementation later this year. We still have a lot of work to do before we finalize our choices, including incorporating changes from the new Quality Management Plan and looking at how we manage the risk for each of the four inspection types.

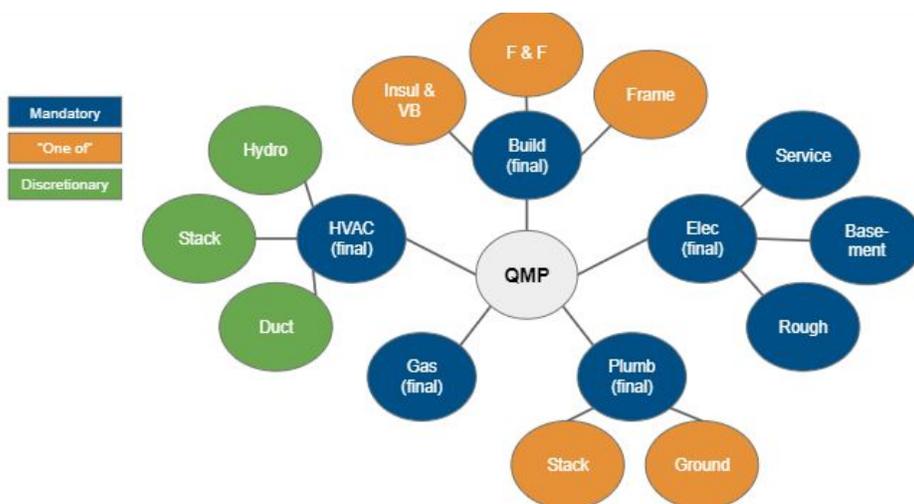
**Using data to determine which inspections have a higher risk of failing based on historical data. This data will be used to apply more of the City's limited inspection resources to the higher risk inspections.*

In order to explore all options and make sure we take enough time to understand risk and the process, we are following these steps:

How the model works

We worked with the Analytics Centre of Excellence to build a predictive modelling tool, the first of its kind being used in Western Canada. The risk model, is about creating a program able to perform tasks that usually require a real person. Examples like navigating directions, following directions through speech command and recognizing pictures to understand were, until recently, decisions that required a real person. Risk modelling is understanding if a computer can confidently predict the same decision that a person would make. Learning to walk and talk are life skills learned by watching others perform the task. The model learns by using previous decisions made by people to predict the outcome of the next decision.

Since the launch of the project, the SCIE project team (Building Partners, Safety Code Council members and City of Edmonton Staff) has been working with the model to establish belief in its ability to make these decisions. The City of Edmonton follows the Quality Management Plan (QMP) to determine which inspections they will conduct. There are some inspections that are mandatory and some that are non-mandatory. The diagram below represents the inspections and their category that fall under the QMP.



How the Model Selects Inspections

We want to be confident that the information that the model is giving us is the same or very close to the results that we would get from real life inspections. Now that the model has learned from 600,000 real life examples, we are able to test the different types of inspections to see if it can predict pass or fail as well as a real life inspection. We specifically wanted to test the inspections where the model told us not to do the inspection but in real life, the inspection failed. This is very important because it helps us tell the model to be more or less flexible when making decisions. The goal for the first four rounds of testing was for the model to understand the risks associated with each decision. Input gathered from the Inspectors and Chief Inspectors allowed the working group (including our

builder partners and safety code council representation) to decide on the four non-mandatory inspections to move forward to the risk level setting phase.

This table shows the non-mandatory inspection, the decision to include or exclude the inspection in October 2019 implementation and the rationale behind the decision.

Inspection	Included in October 2019 Implementation	Rationale behind decision
Footing and Foundation non-mandatory inspections	No	<ul style="list-style-type: none"> - Removed from implementation in 2019 - Footing and Foundations quick win implemented in 2018 produces stronger results.
Plumbing Ground non-mandatory inspections	Yes	<ul style="list-style-type: none"> - Performed well during testing One of the two non-mandatory inspections must be completed -Will move on to the next stage of identifying the appropriate level for October 2019 implementation.
Plumbing Stack non-mandatory inspections	Yes	<ul style="list-style-type: none"> -Performed well during testing -One of the two non-mandatory inspections must be completed - Will move on to the next stage of identifying the appropriate level for October 2019 implementation.
Building: Framing First non-mandatory inspections	No	<ul style="list-style-type: none"> -Scored lowest performance during testing -Not supported by the data scientist due to the variability of the inspection -Not moving forward and will be re-evaluated at a later date.
Building: Insulation and Vapor Barrier non-mandatory inspections	No	<ul style="list-style-type: none"> - Over 60% of failed inspections were outstanding from conditional framing -High change of business process required -Not moving forward and will be re-evaluated at a later date.
HVAC: Stack non-mandatory inspections	Yes	<ul style="list-style-type: none"> - Ranked the highest with survey and testing - One of the three discretionary inspections must be completed - Will move on to the next stage of identifying the appropriate level for October 2019 implementation.
HVAC: Concealed Duct non-mandatory inspections	Yes	<ul style="list-style-type: none"> -The lowest in volume (approx 25% of overall) inspection as it only occurs when a developed basement is present - One of the three discretionary inspections must be completed - Will move on to the next stage of identifying the appropriate level for October 2019 implementation.

How We Manage Risk

With the four non-mandatory inspections selected to move forward to the risk level setting stage, we will be busy over the next couple of months. Next steps include:

- Engaging with citizens, builders, contractors and employees of the City of Edmonton to identify what is needed for roll-out and understanding the change;
- Continue to update the progress of our project working group to city building partners and Safety Codes Council;
- Identify processes to make sure the model has enough information to continue learning;
- Develop a process incorporating immediate response for unplanned situations;
- Host information sessions for citizens, builders and contractors.

Implementation:

Once the risk level has been solidified, we will commit to:

- Ongoing communication with the citizens, builders and inspectors for the October roll out;
- Implementing the model at the right level for the identified inspections;
- Integrating the model with inspection scheduling;
- Transitioning to operations who will be accountable for the model after 2019 and will continue to understand, test and oversee future implementation to other non-mandatory inspections.

Questions & Answers:

If there is no inspection, will homeowners be unsafe?

No, all mandatory and most of the discretionary inspections will continue to happen by Inspectors. Our Safety Code Inspectors will continue to support homeowner's safety by auditing builders work. The Builder or Contractor is responsible to ensure the work they were hired for is done safely, correctly and up to code. The inspectors role is to provide quality control on the builder or contractors work.

2. The model is not an Inspector, how can the model know what my Inspector knows?

Correct, the model is not an inspector but it uses previous inspector experience. First, we give the model information collected from 600,000 real-life examples (this is the data that inspectors have put into Posse from 2006-2018). The data we give it includes information on building attributes, geographical information, contractor attributes and inspection attributes. Second, the model takes all the data from the real life examples and uses it to learn about how real inspectors make decisions. It learns what things contribute to an inspection pass and what other things contribute to an inspection fail. During the training time, we check what the model says against the real life inspection information to see if the model made the right decision. After a certain amount of time, the model demonstrates that it can make a risk based decision based on previous inspector experience. **This is where we are now.** This is what we are testing for so that we can be confident in the results of the model. Lastly, in order to make sure that the model continually has real life examples to learn from, we will do a certain number of inspections even if the model tells us we don't need to.

How many inspections were tested? The data used for the testing included over 5700 non-mandatory inspections that were completed in 2018.

How many inspections will not happen once this is implemented in October?

The number of inspections will depend on what level the model is set at to decide if a pass the first time will be the result. This is dependant on the history of the builders ability to pass the inspection the first time around. If there are high rates of passing inspections the first time in real life, it's likely that the model will tell us that we don't need to do the inspections as often. If the real life data has shown that there are higher failure rates, they we will likely have to do more inspections.

Now that we know which of the non-mandatory inspections have been selected, we will focus on those non-mandatory inspections to determine what level the model will be set at to answer this question.

Will permit fees change as a result of the model implementation?

The cost of each permit includes the required inspections tied to that permit, but are not determined by each inspection. Permit costs are not currently under review and are handled by a separate biannual process within the City.

Who else is supportive of this work?

We have spoken with Safety Codes Council and Alberta Government about the concept of this tool to ensure we have legislative support. Both groups agree that this is the right solution in order to keep up with the demands placed on municipalities. In addition, to ensure the tool is technically sound, it was reviewed and validated by the machine learning institute at the University of Alberta.

I want to get involved or have other questions. Who do I contact?

We would love to hear from you to answer any questions or let you know how you can be involved. Please contact the Safety Codes Inspection Efficiencies team at uftransformation@edmonton.ca.

Future project updates will be shared using the Building Edmonton Newsletter. We encourage you to sign up for this newsletter.