PROJECT SUMMARY

ITM Data Exchange
29 April 2019

Background: Many NFPA codes and standards establish minimum frequencies for periodic inspection, testing, and maintenance (ITM) for fire protection systems, including for example, NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, and NFPA 72, National Fire Alarm and Signaling Code. These frequencies are often historical requirements that are often not based on empirical ITM data or observed deficiencies. In recent years there has been growing interest in risk/occupancy-based and performance-based ITM frequencies; however, to be effective there is a need for a more data-based approach to ITM frequencies. While the use of digital ITM data collection software are evolving, there remains great variation in the format that ITM data is collected, stored, and analyzed. Due to the inconsistency in ITM data collection methodologies, it is difficult to implement data-informed decision-making regarding system reliability, ITM frequencies, and risk acceptability.

The Fire Protection Research Foundation (FPRF) has previously lead projects on ITM Data Collection and Analytics that have concluded that additional work needs to be done in order to evaluate and correlate fire protection equipment reliability with code requirements. Some of the identified gaps are the lack of standardization of ITM data format, collection, and submission processes, as well as unresolved issues regarding data access, ownership, security parameters, and others.

Data from the Inspection, Testing, and Maintenance of Fire Protection Systems have value to a large variety of stakeholder groups including Contractors (i.e. inspectors), Building Owners/Facility Managers, Authorities Having Jurisdiction, Equipment Manufacturers, Insurance companies, NFPA Codes and Standards Technical Committees, Consultants, and others. Despite the widespread appreciation of the importance of ITM data, there is currently no universally adopted data model, or standardized data format, that all stakeholders utilize to share and compare data. This lack of standardization not only limits the ability to determine sound performance-based inspection frequencies, but it also limits the abilities of all stakeholder groups to exchange and analyze data to inform decisions for their own local needs.

Defined Terms and Phrases. The following are definitions of terms and phrases used throughout this project prospectus:
- All references to the term "*data exchange model*", shall be interpreted as "the logical inter-relationships and data elements involved in the information world. It also documents the way data are stored and retrieved and represents what data is required and what format is to be used for different business processes[1]." This is distinct from and not related to fire protection engineering models, predictive analytics models, fire dynamic simulator models, etc.

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[1] https://www.techopedia.com/definition/18702/data-model

- All references to "*extensible*" technology shall be interpreted as "extensibility is a measurement of a piece of technology's capacity to append additional elements and features to its existing structure."[2]
- All references to "pilot test" within this project is intended to be interpreted as the testing of the data exchange model in a real-world user environment where the collected diverse sample of ITM data is input into the initial, extensible, ITM data model to demonstrate and evaluate the use and functionality of the ITM data exchange model.
- All references to "data standardization" within this project is intended to be interpreted as the process in which similar data received in various formats is transformed to a common format that enhances the comparison process.

Key Assumptions. The following are key assumptions used by this project:
- There are many different stakeholders who have varying interests and/or investments in how ITM data are collected and shared, including but not limited to, fire protection system manufacturers / designers / installers, ITM inspectors, software vendors specializing in collecting and/or exchanging ITM data, building owners, facilities managers, and Authorities Having Jurisdiction (AHJ). Each of their use cases may differ in terms of what data they need, value, or are willing to share.
- There are various existing approaches for collecting ITM data in equally diverse formats across the fire protection community.
- Given the diversity of use cases based on the different types, formats, and reasons that data are collected and shared across the ITM community, it is anticipated that any data exchange model developed will need to be dynamic and designed to allow for growth, typically known as extensibility.
- It should be noted that some companies, vendors, and other stakeholders may have different limitations on what data can be shared, in what format, and how anonymized it must be.

Research Goal: The goal of this project is to develop and pilot test a comprehensive, scalable, and extensible data exchange model to facilitate ITM data sharing from diverse ITM data sources.

Project Tasks: The research goal shall be achieved through the following tasks, which will be conducted under the auspices of the Research Foundation in accordance with Foundation Policies and will be guided by a Project Technical Panel of industry stakeholders:

Task 1: Participate in Focus Group Meetings and Assess Stakeholder Needs and Use Cases for an ITM Data Exchange. Focus group meetings shall be held to solicit feedback from participants to support the assessment and documentation of all applicable use cases and needs for an ITM data exchange.

Task 2: Conduct a literature review on existing data architectures, data models, and exchange approaches.
- Task 2(a): Review existing ITM Data Architectures. Utilizing the information gathered from the focus group sessions in Task 1 and additional background research, review existing ITM data collection methodologies and data architectures, specifically looking at the data elements collected, data formats, data security protocols, etc. and assess the data infrastructure requirements and implementation considerations for an ITM data exchange. Identify any key challenges with the existing ITM data architectures.
- Task 2(b): Conduct a literature review on existing data models and exchange approaches. Provide an overview of existing data models that could be used for ITM data and discuss the data ingestion,

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[2] https://www.techopedia.com/definition/7107/extensible

analysis and exchange approaches. Make a recommendation for the optimal data model and proceed with this methodology for the following steps.

Task 3: Develop the Methodology and Framework for an ITM Data Exchange Model. This data exchange model should utilize international best-practices (e.g. graph approaches for linking data or other well documented approaches) for the collection and exchange of ITM data. Justify how this approach is extensible and applicable for new types of data and systems. Address how future revisions to the developed data exchange model would be handled. This task shall consist of the following subtasks:
- Task 3(a): Collect and assess ITM data elements and datasets. Collect a sample of diverse ITM data from multiple sources to capture the various formats and nomenclatures for at least 3 specific applications (e.g. fire pumps, fire alarms, wet-pipe sprinkler systems, etc.)
- Task 3(b): Establish ITM Vocabulary. From the collected data, develop a draft ITM vocabulary.
- Task 3(c): Develop preliminary ITM Data Relationships. Identify connections between relational data based on the established vocabulary.
- Task 3(d): Establish draft project deliverables for Workshop Evaluation. The draft project deliverables are intended to include 1) the development of an initial, extensible, data exchange model for the ingestion, storage, use and exchange of diverse ITM data; and 2) a draft report documenting the analysis, methodology, and model development strategies. The draft deliverables shall be reviewed with the project technical panel prior to the workshop.

Task 4: Workshop. The baseline materials developed in the previous tasks will be further evaluated, discussed, and refined at the workshop. The workshop will seek to clarify, confirm, add, or refine detailed information and deep insight based on group discussions and additional field experience of ITM activities and data collection.

Task 5: Post-Workshop Refinement. Based on the feedback from the stakeholder workshop and further analysis, the contractor shall refine the data exchange model, as necessary.

Task 6: Pilot test the initial and extensible ITM data exchange model. Using the sample of diverse ITM data collected in Task 3, pilot test the initial, extensible, ITM data model to demonstrate and evaluate the use and functionality of the ITM data exchange model.
- The data collected during this project should be used to consolidate the various formats of ITM data, and to test and validate the common assumptions in ITM inspection frequencies, among other questions to support the NFPA Codes and Standards.

Task 7: Develop a final report. Develop a final report that fully documents all aspects of this project in a user-friendly format that will be published on the FPRF website.

Project Meetings:
- Focus Group Meetings: This project will include focus group meetings, which will be held to assess stakeholder needs and to identify use cases for an ITM Data Exchange.
- Workshop: This project will also include a workshop, planned and facilitated by FPRF, to review the draft deliverables to enable constructive review and refinement by technical experts. At the workshop, attendees will discuss, define, and categorize ITM data and identify the logical interrelationships of ITM data elements and how it fits into the proposed data model methodology.

Annex A: Vision for ITM Data Exchange

The content provided within this annex is intended to provide an example of the current ITM data landscape and envisioned methodology for an ITM Data Exchange.

There are currently hundreds of ITM activities being conducted that are documented on thousands of different forms and formats. This lack of standardization not only restricts the ability to determine sound performance-based inspection frequencies, but it also limits the abilities of all stakeholder groups to exchange and analyze data to inform decisions for their own local needs. The general objective of this project is to develop a repeatable, reproducible, and sustainable process (i.e. model) that will optimize ITM Data Collection and Analytics methods to provide a value-added impact to ITM Stakeholders. This initial phase will develop, and pilot test the comprehensive, scalable, and extensible data exchange model to standardize the format of collected ITM data to facilitate data sharing.

Current ITM Data Landscape

Currently, Codes and Standards (i.e. NFPA) specifies requirements for the inspection, testing, and maintenance of fire protection safety systems, which can be adopted into law. If the applicable code or standard specifying ITM requirements is adopted into law, it is the responsibility of the AHJ to enforce it, thus requiring the End User (i.e. Building Owner or Facility Manager) to inspect, test and maintain their systems (if present). To complete the ITM activities at the specified frequency, a qualified contractor or inspector is typically hired to conduct the ITM activities, unless there is qualified personnel on staff. As 3rd party ITM software and reporting programs continue to evolve, contractors are often utilizing them as a platform for collecting the data. After the ITM data is collected for a particular facility, it is then provided back to the building owner or facility manager, and is made available to the AHJ upon request. This process is depicted in Figure 1 below.
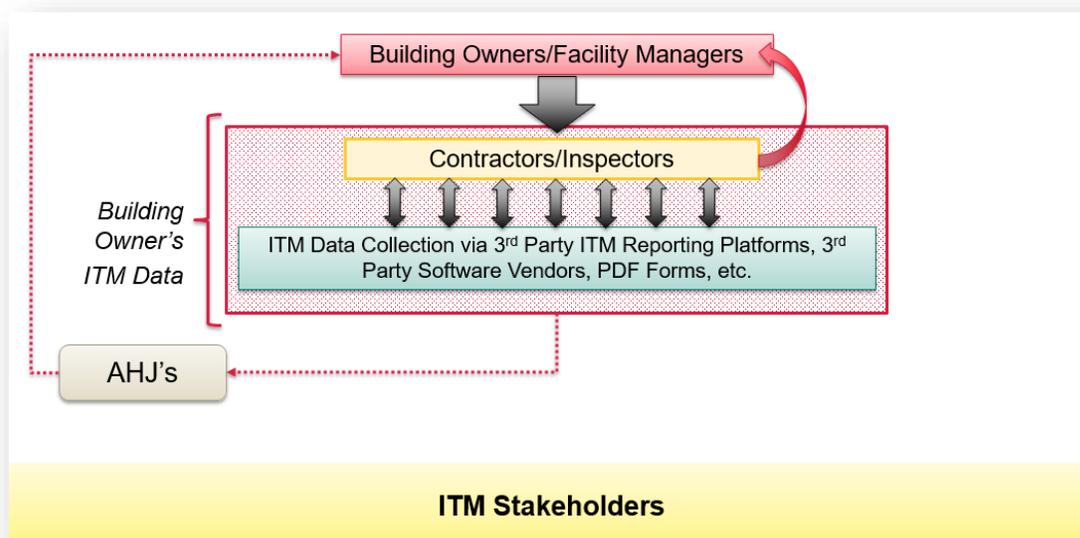

Figure 1 Current ITM Data Landscape

However, it should be noted that there is currently no connection between the data reported from ITM activities and the ITM Stakeholders to enable data-based decision making.

Vision for Application of ITM Data Exchange Model

The vision for the ITM Data Exchange Model is to provide a means of allowing collected data to be consolidated, refined and standardized to facilitate data sharing for the benefit of the fire protection community. This project specifically focuses on the development of the conceptual, flexible and extensible data model to support this vision. The data exchange model is anticipated to be capable of consolidating and standardizing diverse ITM data. The ITM data exchange model is expected to enable data analytics to be applied to the standardized data to derive insights that can be exchanged with ITM Stakeholders for evidence-based decision making.
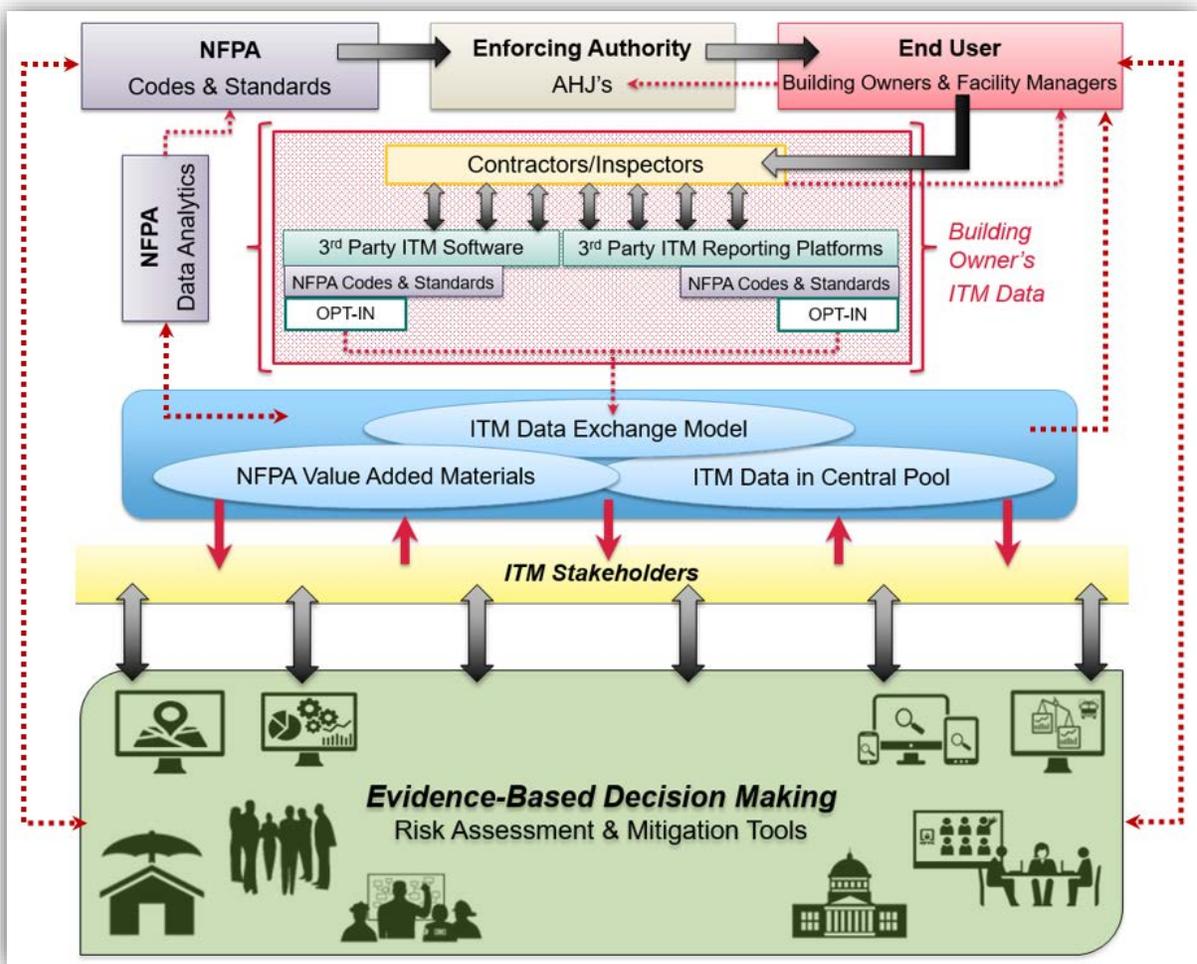

Figure 2 Envisioned ITM Data Exchange

Please note, the black arrows in Figure 2 are intended to represent processes, while the red arrows are intended to represent the flow of ITM data.