

A collection of line drawings related to maritime and industrial themes. The drawings include a ship on waves, a crane, a barrel, a ladder, a bucket, a tank, and various tools like a wrench and a screwdriver. There are also some abstract shapes and a small circle.

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A collection of line art icons related to oil and gas. The central figure is a worker wearing a hard hat and holding a large sheet of paper. Surrounding the worker are various pieces of equipment: a tanker truck, a pumpjack, a wellhead, a valve, a fuel nozzle, a tank, a control panel, a crane, and various tools and equipment. The icons are arranged in a circular pattern around the central worker.

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1. Introduction

The Gas Permits and Inspections Analytics System is designed to analyze and visualize data from the City of Calgary's public dataset on gas-related building permits and inspections. This includes applications, processing timelines, inspection outcomes, and contractor performance across the 2023–2024 period.

1.1 Industry Background

The construction and utility sectors depend heavily on regulatory compliance, particularly concerning gas installations. Municipalities like Calgary issue thousands of gas permits annually, and each permit must undergo one or more inspections. Delays, re-inspections, and service-level breaches can result in safety risks, operational inefficiencies, and increased costs.

1.2 Business Problem

Despite the availability of permit data, most cities lack intuitive platforms that consolidate and interpret inspection and permit performance metrics. This makes it challenging for city planners, inspectors, and contractors to:

- Identify inspection bottlenecks
- Monitor performance trends across regions
- Benchmark contractor reliability
- Track service level agreement (SLA) compliance

2. Goals

The primary objective of the Gas Permits and Inspections Analytics System is to enhance operational transparency, improve permit processing workflows, and support performance-based decision-making for stakeholders. The system is built around answering key operational questions through well-defined performance goals:

1. **Optimize Permit Processing Efficiency**

Track and reduce the average time taken to process gas permit applications from submission to approval.

2. **Improve Inspection Service Levels**

Monitor whether inspections are completed within the defined service-level agreements (SLAs), helping ensure timely and efficient service delivery.

3. **Enhance Quality Assurance**

Measure inspection pass rates and reduce the number of failed inspections to ensure installations meet required standards on the first visit.

4. **Reduce Re-inspection Rates**

Identify trends and patterns that lead to repeated inspections, enabling targeted interventions and contractor performance evaluation.

These goals are designed to support continuous improvement in municipal gas permitting and inspection processes, drive operational accountability, and promote safer construction practices in Calgary.

3. System Overview

The analytics system uses structured data from the **City of Calgary Open Data Portal** focused on gas permits and inspections. The dataset is transformed into relational models and used to power a suite of interactive dashboards in Power BI.

3.1 Business Problem

The system answers critical questions such as:

- What is the average permit processing time?
- How many inspections meet their SLA?
- What is the pass rate on first inspection?
- What is the re-inspection rate per contractor or region?

4. Key Performance Indicators (KPIs)

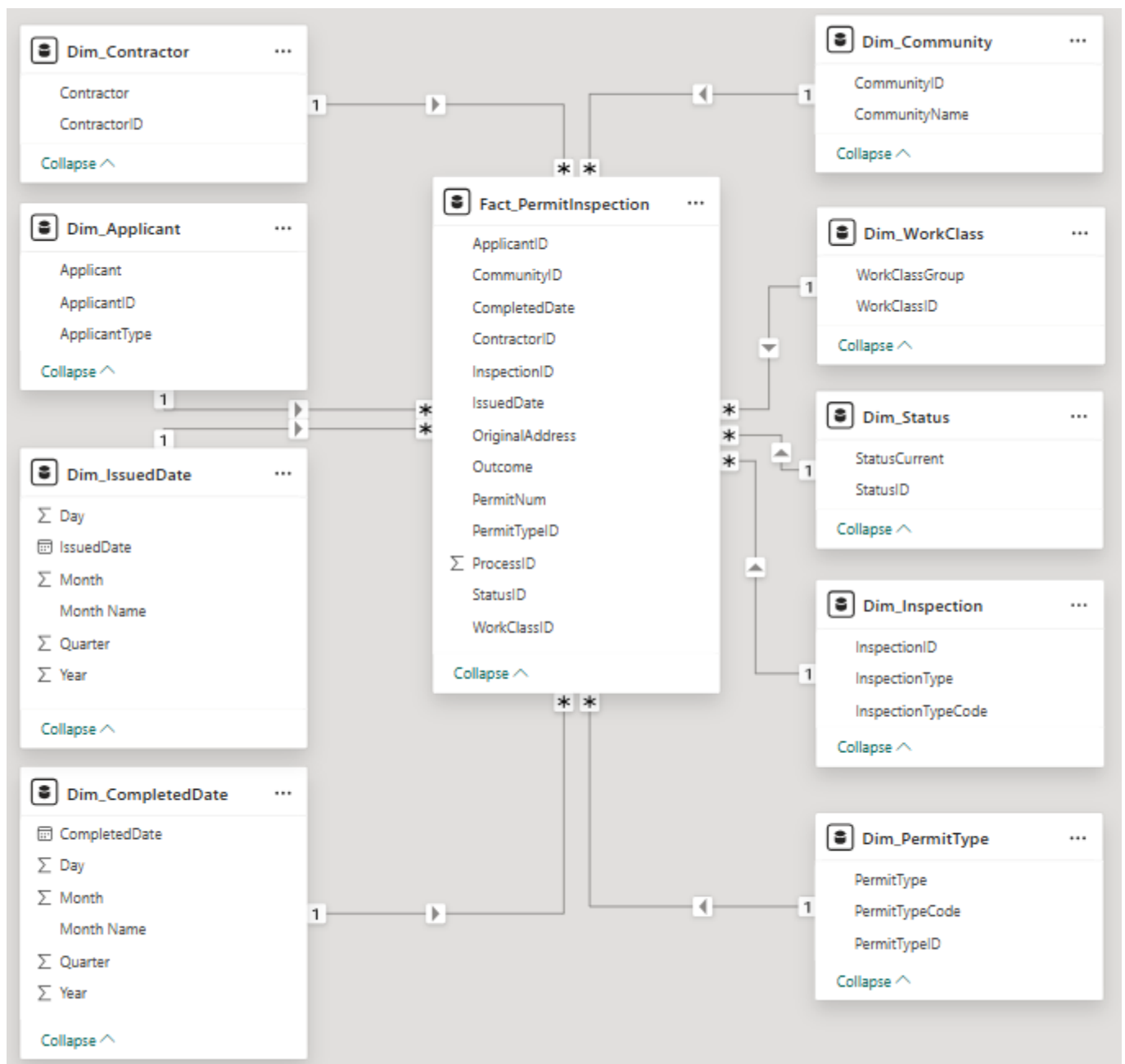
The following KPIs drive the performance evaluation in the dashboards:

KPI Name	Description
Average Permit Processing Time	Average duration between application and final decision
% Inspections Completed Within SLA	Inspections done within the service-level window
Inspection Pass Rate	% of inspections that passed on the first attempt
Re-inspection Rate	% of inspections requiring follow-up

These KPIs are integrated into cards and time-based visualizations across different dashboard sections.

5. Data Model Overview

The Gas Permits and Inspections Analytics System utilizes a **star schema** data model, optimized for fast analytics and intuitive reporting. At the center of the model is the **Fact_PermitInspection** table, surrounded by multiple dimension tables that provide descriptive context for analytical slicing and filtering.



5.1 Fact Table: Fact_PermitInspection

This is the **central table** that stores measurable, event-based data related to gas permits and inspections. It captures both **permit-level** and **inspection-level** information.

Key Fields:

- ApplicantID: Links to the applicant requesting the permit
- CommunityID: Area or zone where the permit applies
- CompletedDate & IssuedDate: Track the timeline of permit processing
- ContractorID: The contractor responsible for the work
- InspectionID: Unique identifier for each inspection
- Outcome: Result of the inspection (e.g., Passed, Failed)
- PermitNum: The official gas permit number
- PermitTypeID, StatusID, WorkClassID: Foreign keys pointing to relevant dimensions
- ProcessID: Derived column used to calculate time between IssuedDate and CompletedDate

5.2 Dimension Tables

Each dimension table is connected via a foreign key to enable **filtering**, **grouping**, and **categorical analysis**.

Dim_Applicant

- Contains details about the applicant (individual or business) who requested the permit.
- Fields: ApplicantID, Applicant, ApplicantType

Dim_Contractor

- Contains data about contractors performing the gas installation work.
- Fields: ContractorID, Contractor

Dim_Community

- Describes the geographic region or neighborhood of the permit.
- Fields: CommunityID, CommunityName

Dim_IssuedDate & Dim_CompletedDate

- Time-based dimensions for analytics over periods like Day, Month, Quarter, and Year.
- Used for trend and SLA calculations.

Dim_Status

- Provides current status of the permit or inspection.
- Fields: StatusID, StatusCurrent

Dim_WorkClass

- Categorizes permits based on the type of work (e.g., installation, repair).
- Fields: WorkClassID, WorkClassGroup

Dim_Inspection

- Details about the type of inspection carried out.
- Fields: InspectionID, InspectionType, InspectionTypeCode

Dim_PermitType

- Provides information on the type of gas permit issued (e.g., residential, commercial).
- Fields: PermitTypeID, PermitType, PermitTypeCode

5.3 Key Relationships

Relationship	Type	Purpose
Applicant → Fact	One-to-Many	Identifies who applied for the permit
Contractor → Fact	One-to-Many	Links inspection and permit activity to the responsible contractor
Community → Fact	One-to-Many	Enables geographic filtering of permit data
IssuedDate → Fact	One-to-Many	Allows tracking of permit submission and approval timelines
CompletedDate → Fact	One-to-Many	Enables monitoring of completion and inspection finalization timelines
Status → Fact	One-to-Many	Tracks current permit or inspection status
WorkClass → Fact	One-to-Many	Segments data by type of work performed
Inspection → Fact	One-to-Many	Categorizes inspection activities
PermitType → Fact	One-to-Many	Differentiates between types of permits issued

5.4 Measures & Performance Metrics

To enable in-depth analytics, a set of custom **DAX measures** were created within the Power BI data model. These measures support real-time monitoring of inspection quality, permit lifecycle performance, and operational bottlenecks.

Each measure is designed to answer a specific key question from stakeholders and aligns with the project's goals of efficiency, quality assurance, and strategic insight.

List of Measures and Descriptions:

Measure Name	Description
% Inspections Within SLA	Calculates the percentage of inspections completed within the expected service-level agreement (SLA) timeframe. Helps monitor efficiency and compliance.
Average Processing Time (Days)	Measures the average number of days between the permit issue and completion dates. Indicates overall permit processing speed.
Contractor Pass Rank	Ranks contractors based on their inspection pass rates. Useful for identifying top-performing and underperforming contractors.
Inspection Pass Rate	Percentage of inspections that passed on the first attempt. Indicates quality of initial work and compliance.
Most Common Inspection Types	Identifies the inspection categories that occur most frequently. Helps in planning resources and prioritizing inspection staff.
Processing Delay Index	A derived score or index measuring the degree of delay across all permit applications. Higher values indicate inefficiencies.
Re-Inspection Rate	Calculates the proportion of permits requiring more than one inspection. A high rate may signal recurring issues with contractors or inspection standards.
Total Inspections	Simple count of all inspection records, including first-time and repeat inspections. Useful for tracking inspection volume.
Total Permits Issued	Total count of permit applications processed and approved during the reporting period. Useful for capacity and trend analysis.
Total Re-Inspections	Total count of inspections that occurred more than once for the same permit. Useful for tracking redundancy and waste.

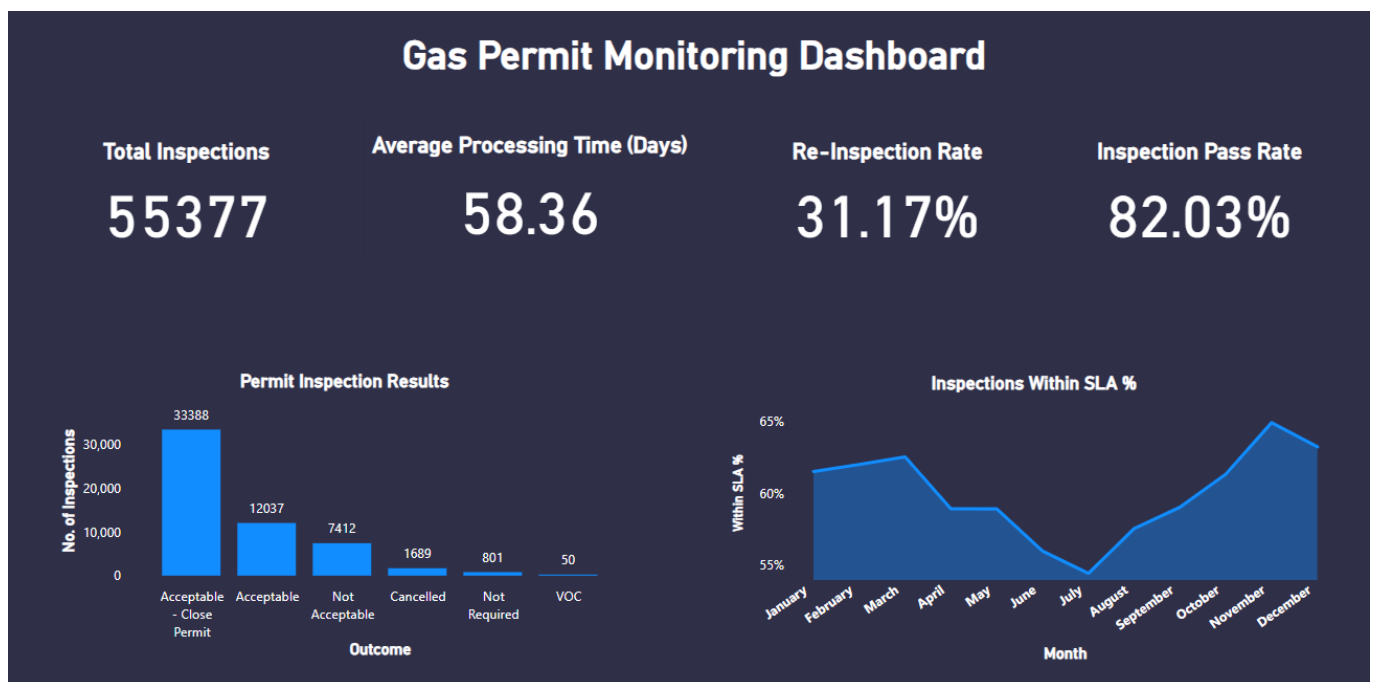
6. Dashboard Layouts

The Gas Permits and Inspections Analytics System includes three interactive dashboards designed to provide different perspectives on gas permit operations. Each dashboard serves a specific analytical purpose, addressing the needs of executives, operations managers, and quality assurance teams. Together, they support a comprehensive understanding of gas inspection workflows and performance trends across Calgary.

6.1 Executive Dashboard

Description:

This dashboard provides a high-level summary of permit and inspection activities, ideal for senior executives and decision-makers who require a quick yet powerful overview of system-wide performance.



Purpose:

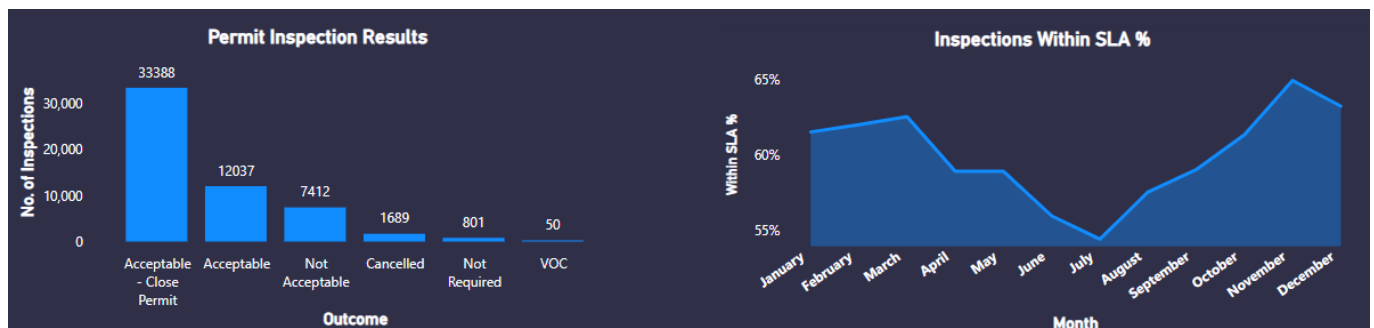
- To track the health of the gas permit and inspection process using key performance indicators (KPIs).
- To ensure alignment with organizational goals related to service quality and regulatory compliance.
- To identify high-level trends and make informed strategic decisions.

Key Features:

- KPI cards displaying metrics such as Average Permit Processing Time, Inspection SLA Compliance, Pass Rate, and Re-inspection Rate.

Total Inspections	Average Processing Time (Days)	Re-Inspection Rate	Inspection Pass Rate
55377	58.36	31.17%	82.03%

- Visual representations of monthly permit issuance and outcome distribution.

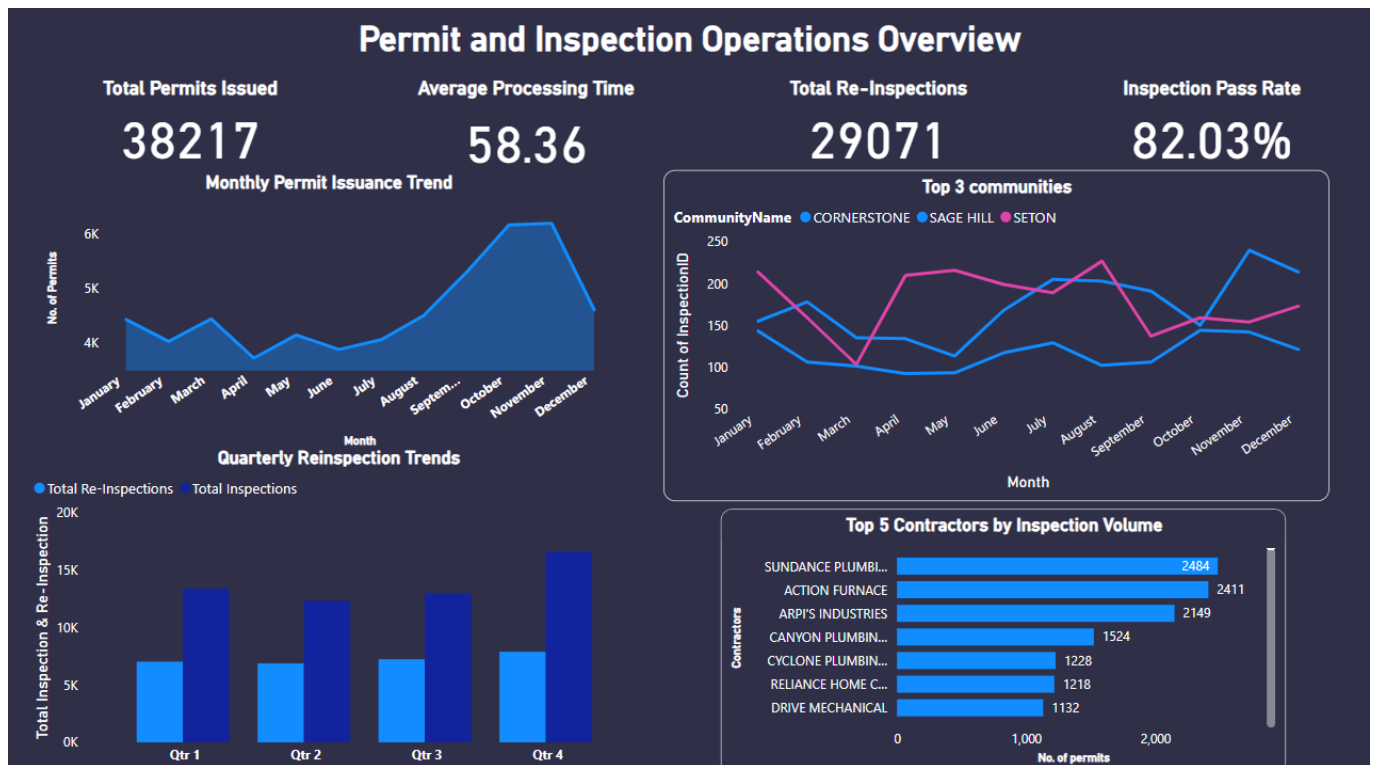


- Clean, simplified layout that prioritizes clarity and decision-support insights.

6.2 Operations Overview Dashboard

Description:

This dashboard presents an operational lens, focusing on real-time performance tracking across multiple dimensions such as geography, contractors, and permit volume.

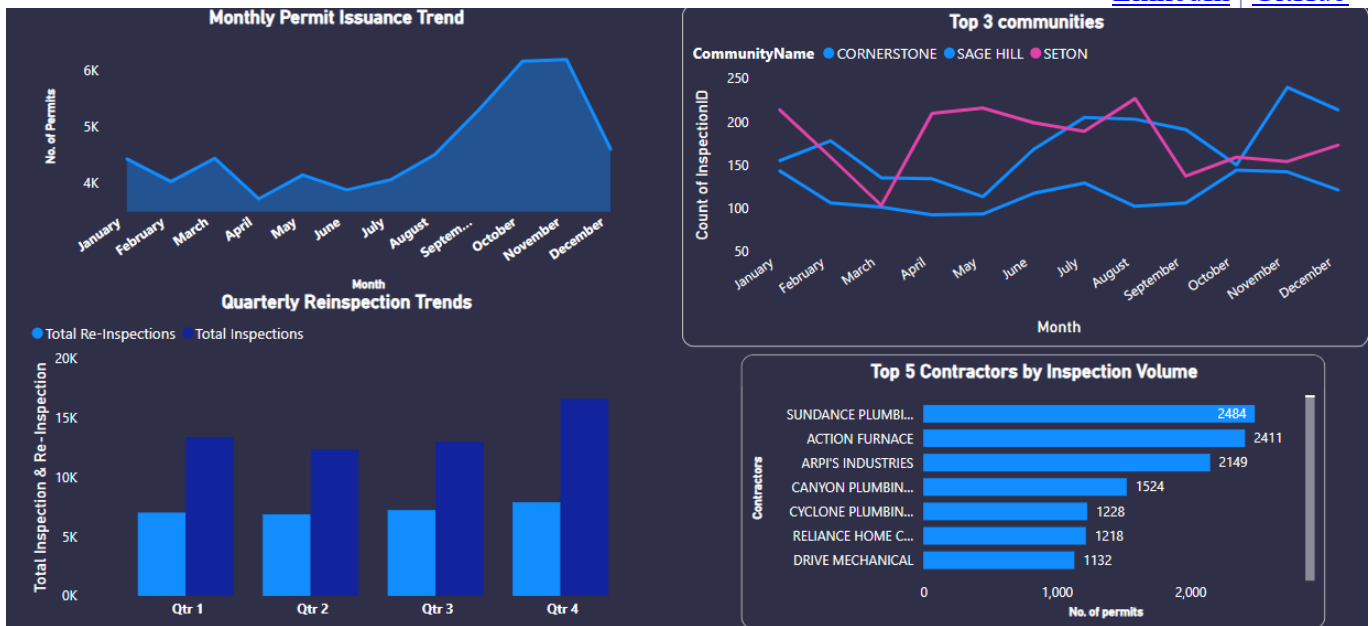


Purpose:

- To assist field supervisors and operational managers in understanding permit workloads across regions.
- To evaluate contractor performance based on inspection outcomes and re-inspection frequency.
- To guide resource allocation and improve overall efficiency.

Key Features:

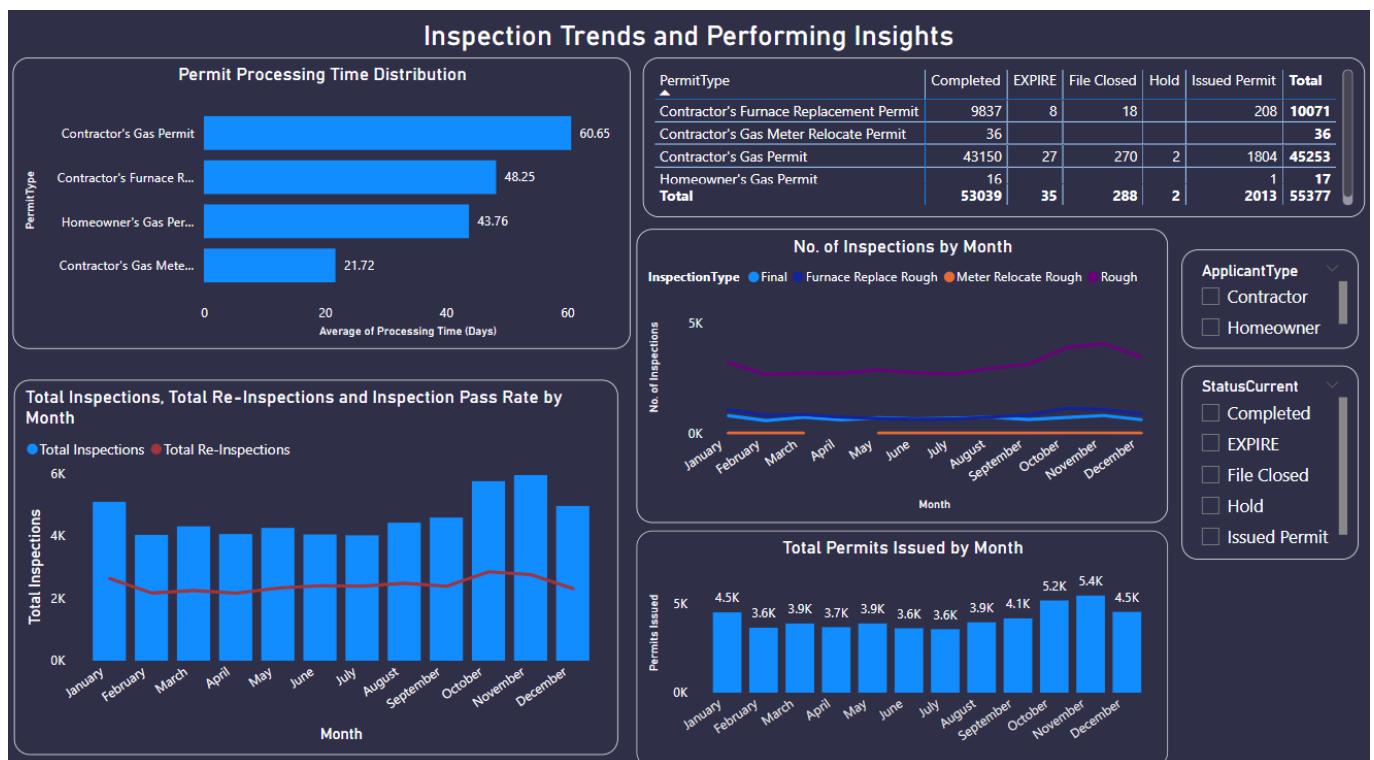
- Heatmaps and geo-distribution charts showing areas with high inspection activity.
- Time-series visualizations of permit and inspection counts.
- Filters to drill down by district, contractor, and date range.



6.3 Inspection Trends and Performance Insights Dashboard

Description:

This dashboard dives deep into inspection-specific analytics, offering a breakdown by inspection type, frequency, outcome, and permit category.



Purpose:

- To analyze inspection lifecycle timelines and identify bottlenecks.
- To support permit planning, especially for high-demand inspection types.
- To maintain a data-driven approach to improving pass rates and service quality.

Key Features:

- Charts comparing initial inspection pass rates vs. re-inspections.
- Temporal analysis showing inspection trends by week, month, and quarter.
- Category-based breakdowns (e.g., residential vs. commercial gas permits).

7. Conclusion

This project successfully visualized and interpreted municipal gas permit and inspection data to surface inefficiencies and quality metrics. The system provides a foundation for more proactive policy-making, operational adjustments, and public transparency.

By highlighting key performance trends, stakeholders can:

- Improve service timelines
- Identify underperforming contractors
- Enforce inspection protocols effectively
- Support smart city initiatives