

# GIS Data Collection and Reduction



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# Audience Survey

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- **Municipal** representation?
- Private sector **engineering consultants** working with municipalities?
- **Directly involved** with post construction GIS data collection and reduction (as built)?
- **Optimized processes** for post construction GIS data collection and reduction?



The **timely** and **efficient** **collection** and **reduction** of **post construction data** for Capital Infrastructure, Private Land Development and other **Municipal business processes**

# Presentation Objectives

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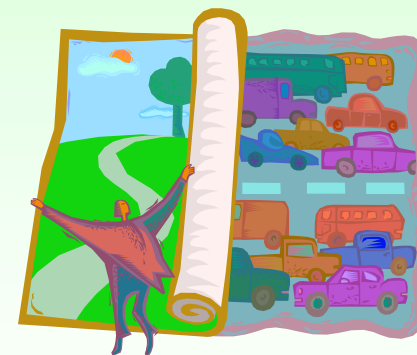
- **Overview** of Capital Infrastructure and Private Land Development Business Processes
- **Guidelines** for Integrating Post construction as-built data collection and reduction into the **GIS data maintenance process**
- **Process** adjustments, employee **roles** and the organization structure
- A look at digital data **standards** and the need to **enforce** consistent data deliverables
- Present **options** for post construction as-built data collection and reduction
- **Implementation Methodology** for carrying out your plans





# Overview

## GIS Input Streams



# GIS Input Streams

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- **New Capital Infrastructure** – roads, sanitary, storm, water and street lighting
- **Private Land Development** – residential, commercial and industrial
- **Capital Infrastructure Maintenance**
- **Parks**
- **Facilities** – civic buildings, community centres etc.



# GIS Input Streams

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Any process resulting in a **change to** the municipal **infrastructure** needs to be **recorded in the GIS**



# Capital Infrastructure Projects (CIP)

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GIS and Asset Management

- **Internal** design and construction by City Public Works or Operations
- **External** design by consultants who tender project for construction with private contractor
- Post construction **deliverables** to public agency should be **same** for both





# Current CIP Deliverables

## At the **Township of Langley...**

### Internal Design and Construction

- **Required** to provide digital as-built drawing
- GIS department currently receiving red line marked up hardcopy design drawing
- Often not **getting what we ask for**

### External Design and Construction

- **Required** to supply digital as-built drawing (Certified Record Drawing), which are modified design drawings to reflect constructed conditions
- Often **getting what we ask for**



- **Developer hires consultant** for design and construction tendering and management
- **Collaborative** effort between Township and Developer



# PLD Deliverables

## At the **Township of Langley**...

- Consultant **required** to provide digital as-built drawings, which are modified design drawings that represents constructed conditions
- Currently receiving **hardcopy and digital** drawing to **no specific format** or standard
- Often **not getting** what we ask for

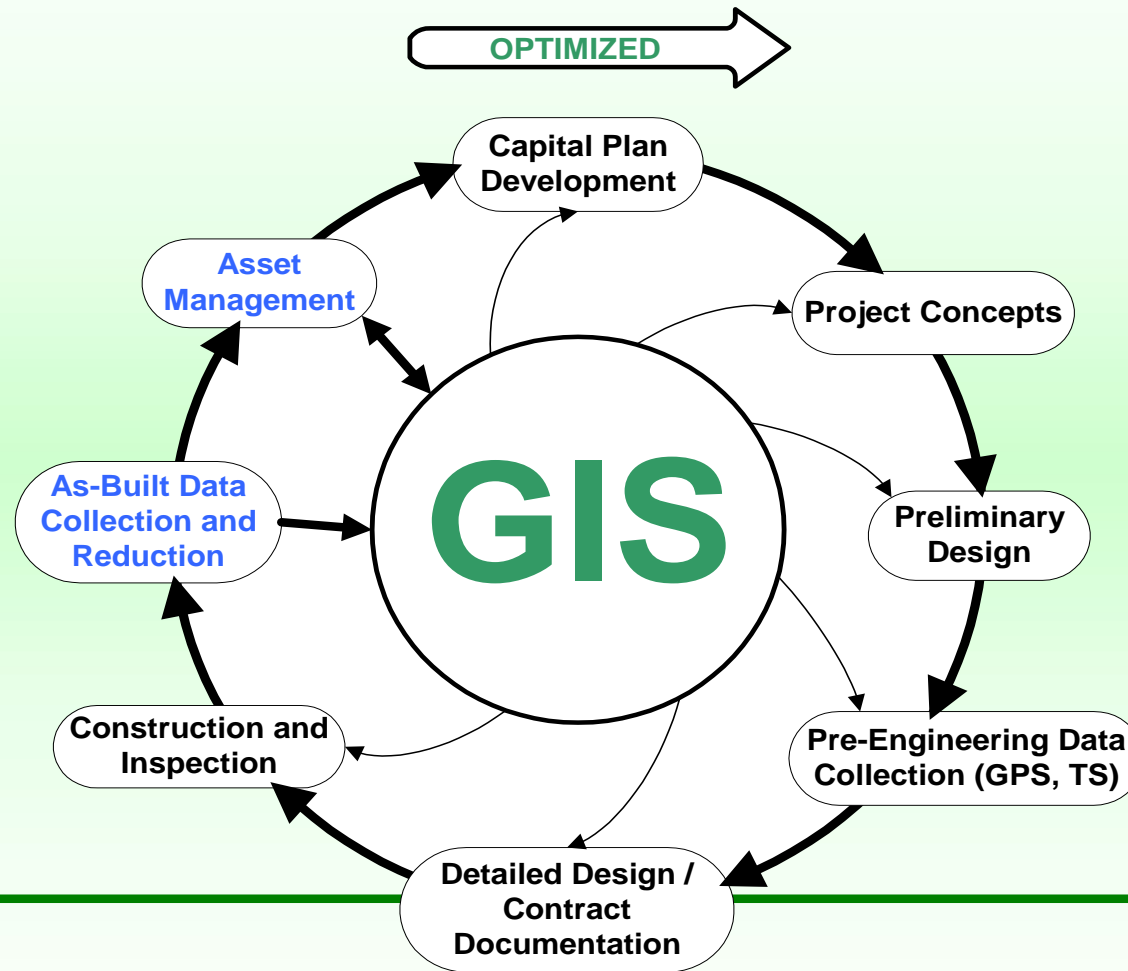


# Typical Project Phases

- Four main phases:
  - Need Identification, planning and conceptualization
  - Design and contract documentation
  - Construction
  - **As-built data collection and reduction**
- Projects involve:
  - Several organizations
  - An **abundance** of data
  - **Technology** and equipment
  - **Human** resources
  - Finances



# Project Life Cycle



**GIS:** The HUB around which **Capital Infrastructure** and **Private Land Development** Business Processes Revolve

# Guidelines For Improvements

# Improvements?

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- **Plan** for Change
- **Optimizing** Technology
- **Mobile GIS**
- GVRD **Real Time GPS** Service
- **Standardization** – processes and deliverables
- Contract **Enforcement** - deliverables
- Business **Process** Adjustments
- Employee **Roles**



# Results

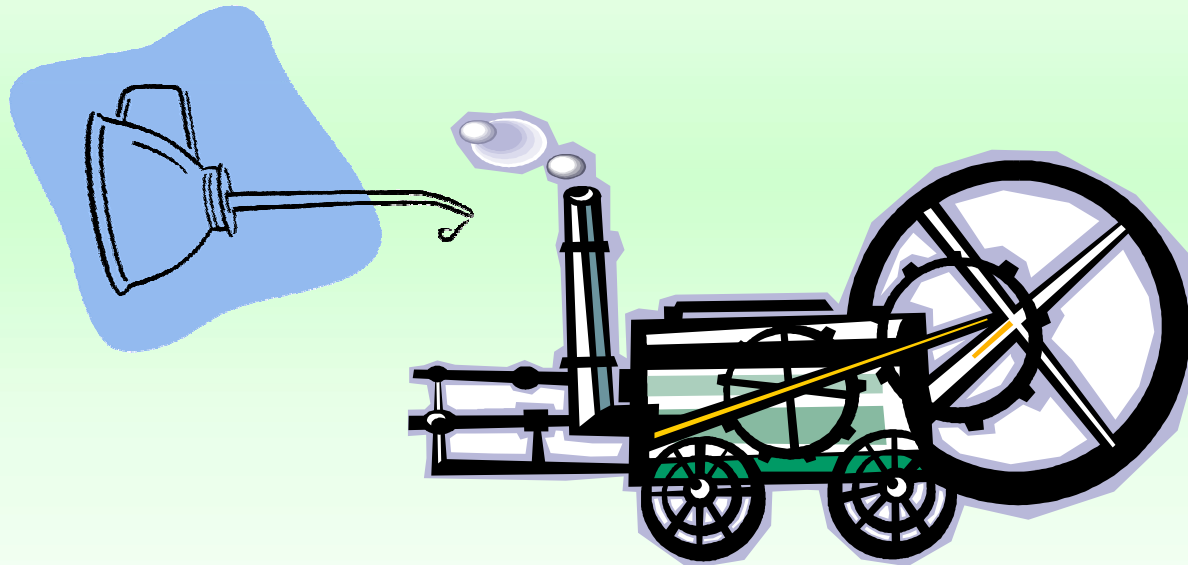
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- **Streamline** business processes
- **Optimize** never ending Technological Expenditures
- Reduce **redundancies** in data collection
- Promote information **sharing**
- Improve **communication** between municipal government and business partners
- Minimize construction changes
- Process **Appreciation**





# Well Oiled Machine!



# Process Adjustments Employee Roles Organization Structure

# Process Adjustments

- GIS Data Collection and Reduction must be recognized as a **timely** and **elemental component** of CIP and PLD business processes
- The job is not done until the data is **in the GIS**



# Employee Roles

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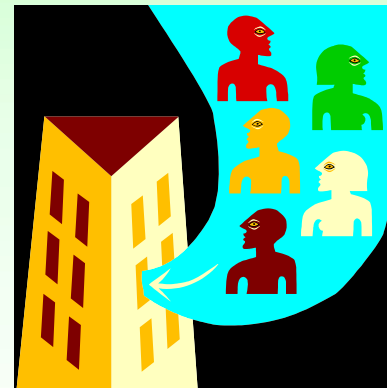
- Must **dedicate resources** to this task
- **Internal** – Construction As-Built Technician
- **External** – Allow For the Role in a Contract
- Field staff (inspectors, supervisors) **must understand** the paramount importance of post construction **GIS data collection**



# Organization Structure

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- Must **support** the process
- **Where** should the role reside?
- Engineering?
- Public Works?
- GIS?



# Standards

# Standardization?

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- Submitted data needs to be in a format that **minimizes post processing** for GIS Entry
- We all need data we can **trust** – it must be certified and standardized
- Use Metadata - **Data about the Data** - at each phase of a project so accurate and complete information is passed on at each hand off.
- **Leverage data** throughout the project life cycle (i.e.: digital data from proposed to constructed)
- Introduces **Cultural Change**



# Options?



# Engineering Drawings

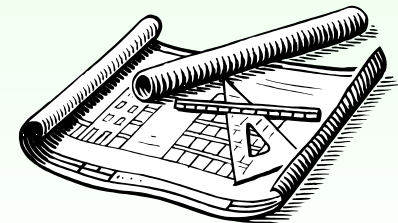
## What are they?



- Engineering drawings are the **definition of the design** and the **instruction for construction**
- The signed engineering drawings introduce **legal liability**
- Consultants **do not want to submit design drawing documents (DWG, DGN)**
- Often **are a data source** for GIS data entry

# GIS Data Collection and Reduction

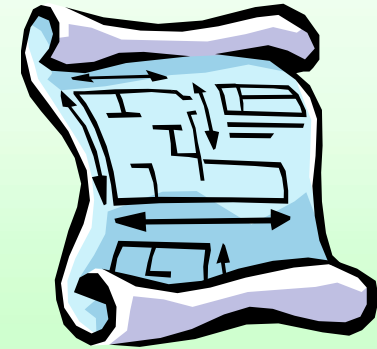
- The **timely** and **efficient** collection and reduction of post construction data for CIP and PLD business processes
- **Minimize post processing** prior to GIS data entry
- **Elemental component** of the process



# Hardcopy Submissions

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**Hardcopy** engineering drawings, or drawing representing constructed conditions

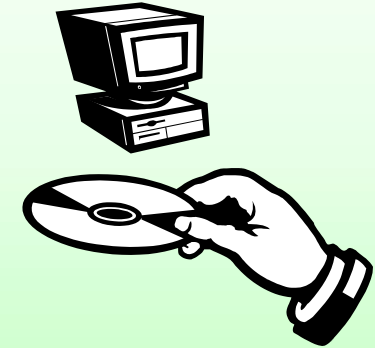


- Duplication of effort
- Data accuracy and reliability
- PDF (Adobe), DWF (Autodesk)
- **Most** Post Processing – need to recreate both spatial and digital data

# Digital Submissions

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**Digital** engineering documents, or drawing representing constructed conditions



- DWG (Autodesk), DGN (Microstation)
- SHP, SHX, DBF (ESRI)
- MIF (MapInfo)
- **Less** Post Processing – need to associate spatial data with attribute data

# GIS Data Sources

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- Capital Infrastructure or Private Land Development?
- Data Sourced From Design Documents?
- As Built Surveys?
- Both?

# GIS Data Sources

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## Design Documents



- Cadastral data
- Gutters, pavement edges, sidewalks
- Indicates **current project activity** in GIS
- Constructed features that **don't change from the design**

# GIS Data Sources

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## Field Surveys (GPS and TS)



- Data accuracy
- Underground utilities
- Street lights, traffic signals utility poles
- Constructed features that **can change from the design**



# GIS Data Sources

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## Field Surveys (GPS and TS)

- **Potentially Even Less** post processing
- Transfer data directly to GIS
- Integrate GPS and GIS
- ArcPad (ESRI)
- Terrasync (Trimble)

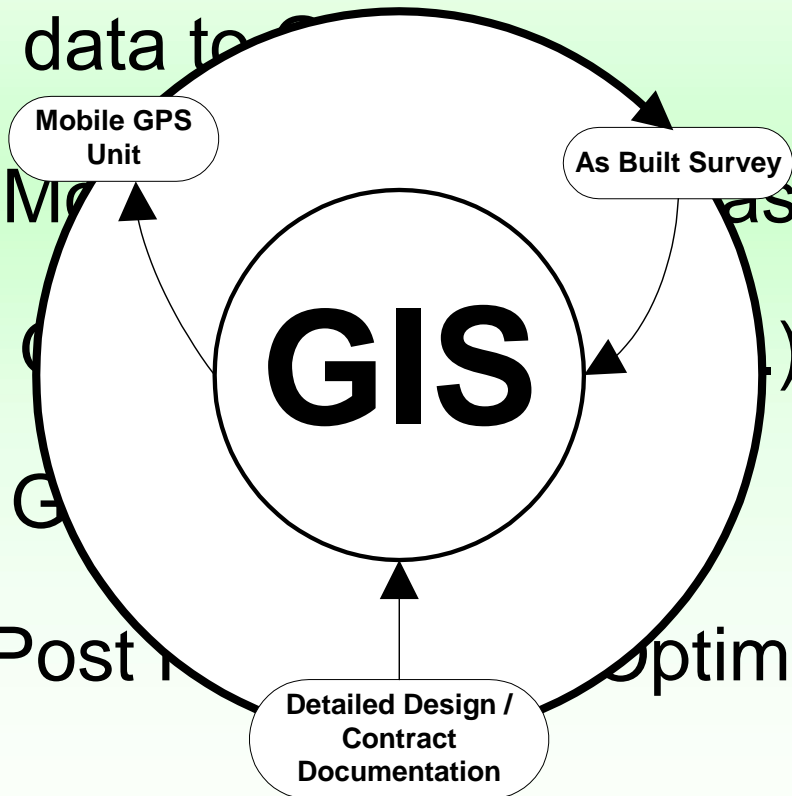




# GIS Data Sources

## Design Data and Field Surveys

- Design data to
- GIS to Mobile GPS (Aerial, roads etc.)
- Collect (
- Mobile GPS
- **Least** Post r Optimal



# Asset Management

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GIS and Asset Management

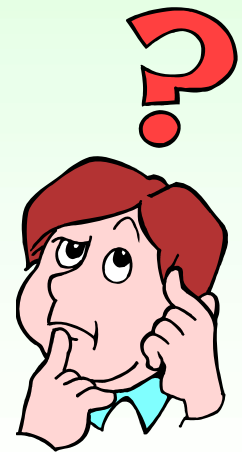
- Linking Asset Management and GIS with design and construction will create efficiencies by reducing paper work and **enabling proactive maintenance**
- Incorporating engineering specifications in the asset management system will **optimize infrastructure maintenance processes**

How?

# How?

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1. Understand **Technologies**
2. Understand **Organization Needs**
3. Needs Assessment – Start With a **Plan**
4. Corporate **Commitment** – Top Down





GIS and Asset Management

# Questions?



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GIS and Asset Management

**Thank You!**

# Asset Management

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- Detailed analysis of resources, materials and equipment usage and costs would be available at all phases of the project.
- Organizations could potentially decrease labor and material costs and optimize resource utilization.
- Potential to link service level agreements to contracts and utilize resource information so that vendor terms are met and unreliable vendors, resources and low quality products are excluded.

# Challenges

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- Surveyors locate corners but don't build topology.
- GIS professionals build topology but don't locate corners.
- Engineers want to know about flow and infrastructure status.
- Operations crews want to know where the manholes are (where to dig).



# Why are Digital Standards important?

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GIS and Asset Management

- Data is requested from the municipal government at conception of any project.
- Data is typically provided as 2D information without attributes attached.
- Data is also exchanged several times during the development process.
  
- Organizations capture and build data and information for their own operational requirements
- We all have different reasons for collecting information and varying accuracy requirements.
- If we consider the entire process we can incorporate other interests requirements into our projects to make transitions and project hand-offs more effective
- Data passes through a complete workflow.
- The same data must be used by all people and organizations involved.
- Traditionally data collected by different organizations are often incompatible resulting in duplication of effort at each project phase (e.g.: Survey and GIS)
- Data may cover the same geographic area but use different geographic bases and standards (Survey and GIS)
- Information needed to solve cross-organization problems is often unavailable
- Many of the resources local government spends on data collection go towards duplicating others data collection efforts (*i.e.: standard drawings in CAD are created by each municipality*)
- Information on assets may not necessarily be linked to CAD or GIS.
- Published, or shared, information needs to be displayed with the appearance everyone expects (*i.e.: as per the Master Municipal Specifications*).
- To use design drawings throughout the entire lifecycle of the engineering project the digital drawings must be updated throughout the project (*i.e.: not just dimensions but the actual data features*).
- *Why not use GPS Data collected in the field to complete the project and update the GIS.*
- *Do we still require As-Built Engineering drawings?*

# What is required?



GIS and Asset Management

## Accurate and clean digital As-Built and Legal Survey Plan files.

More specifically, we need:

1. **Accuracy** – What is drawn in the digital file accurately represents what was constructed in the field.
2. **Clean and well organized** files.
3. **Bare minimum standards** that apply to only as-built features
  - As-built information must be placed on appropriate layers according to the supplied schema (so we can find it)
  - As-built line work must be clean and clearly showing how features connect
  - Referenced information (attached files) need to be clean as well
  - As-built features must be drawn with standard drawing objects
  - If non-standard font files are used the Font shapefile must be provided with the submission
  - A standard format plotter driver (.PC3) must be submitted so we can reproduce the drawings.
  - The .CTB file used for your layering must also be submitted so we can understand and use your layering parameters effectively.
4. **Mapping information contained in the digital file is registered to establish survey control** so we can georeference (locate) the information properly within the Municipal Boundary.