2016

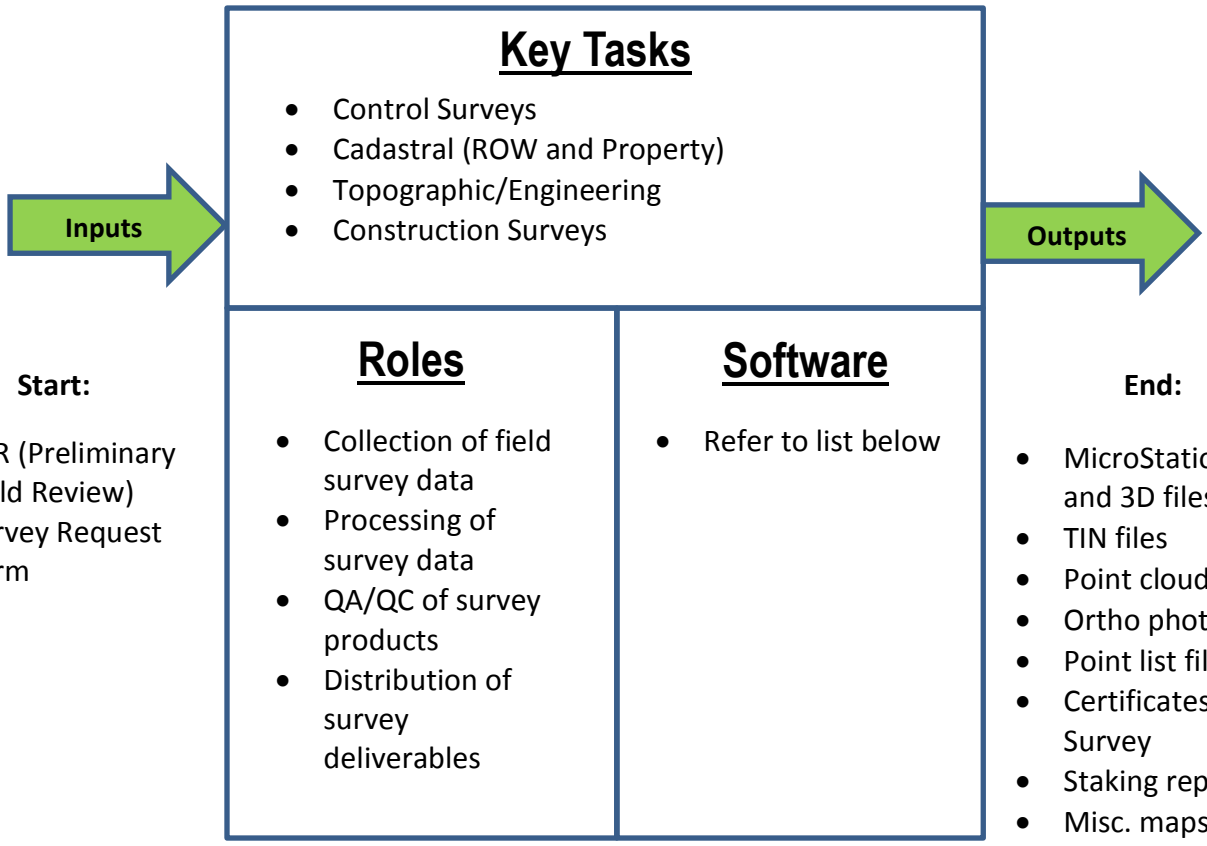
3D Study

and Implementation Plan

Appendix A – Discovery Session #1 – As-Is Summaries

January 29, 2016

Group Name: Photogrammetry & Survey / District Survey Unit / District Construction
Process Name: Surveying



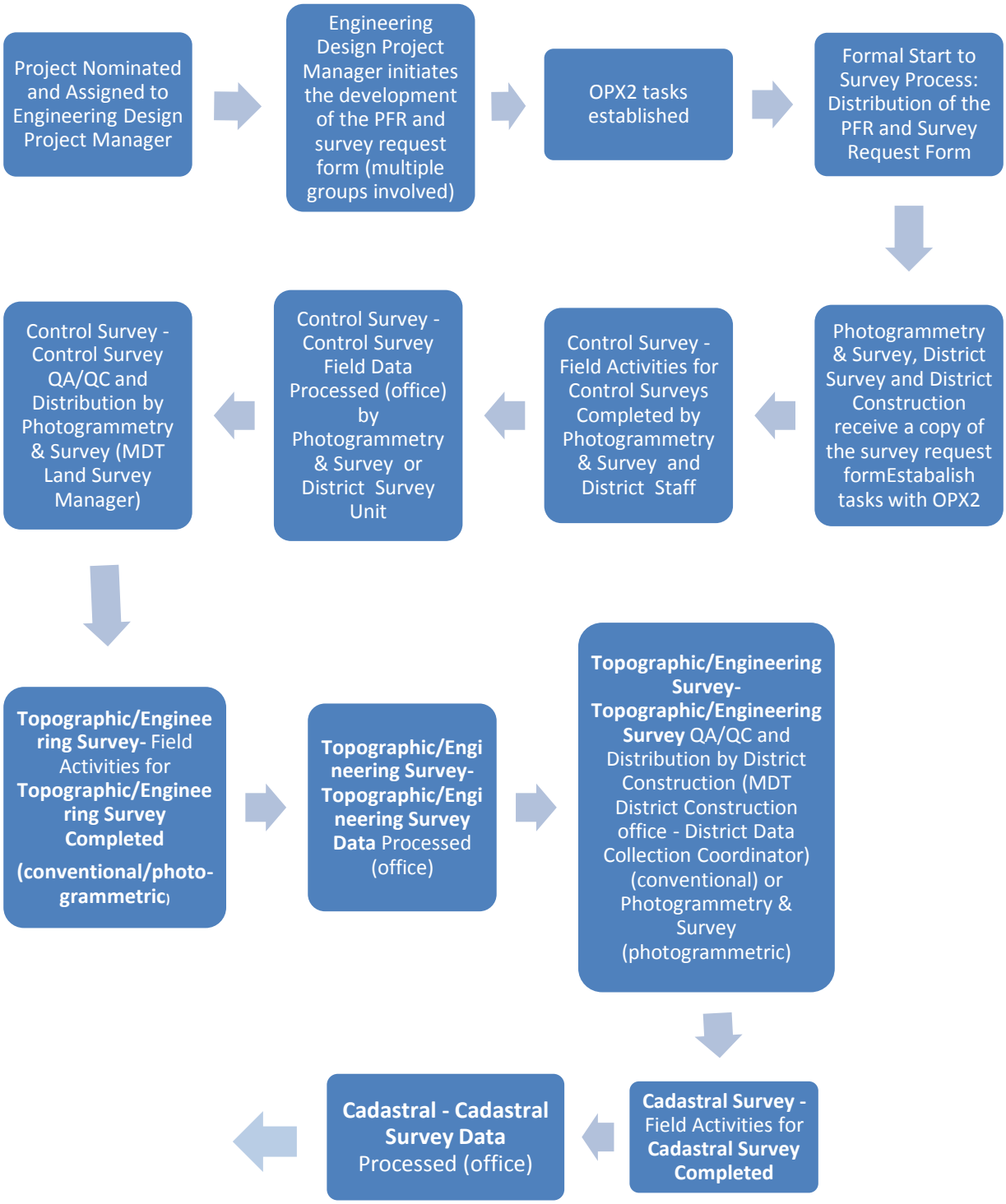
Start:

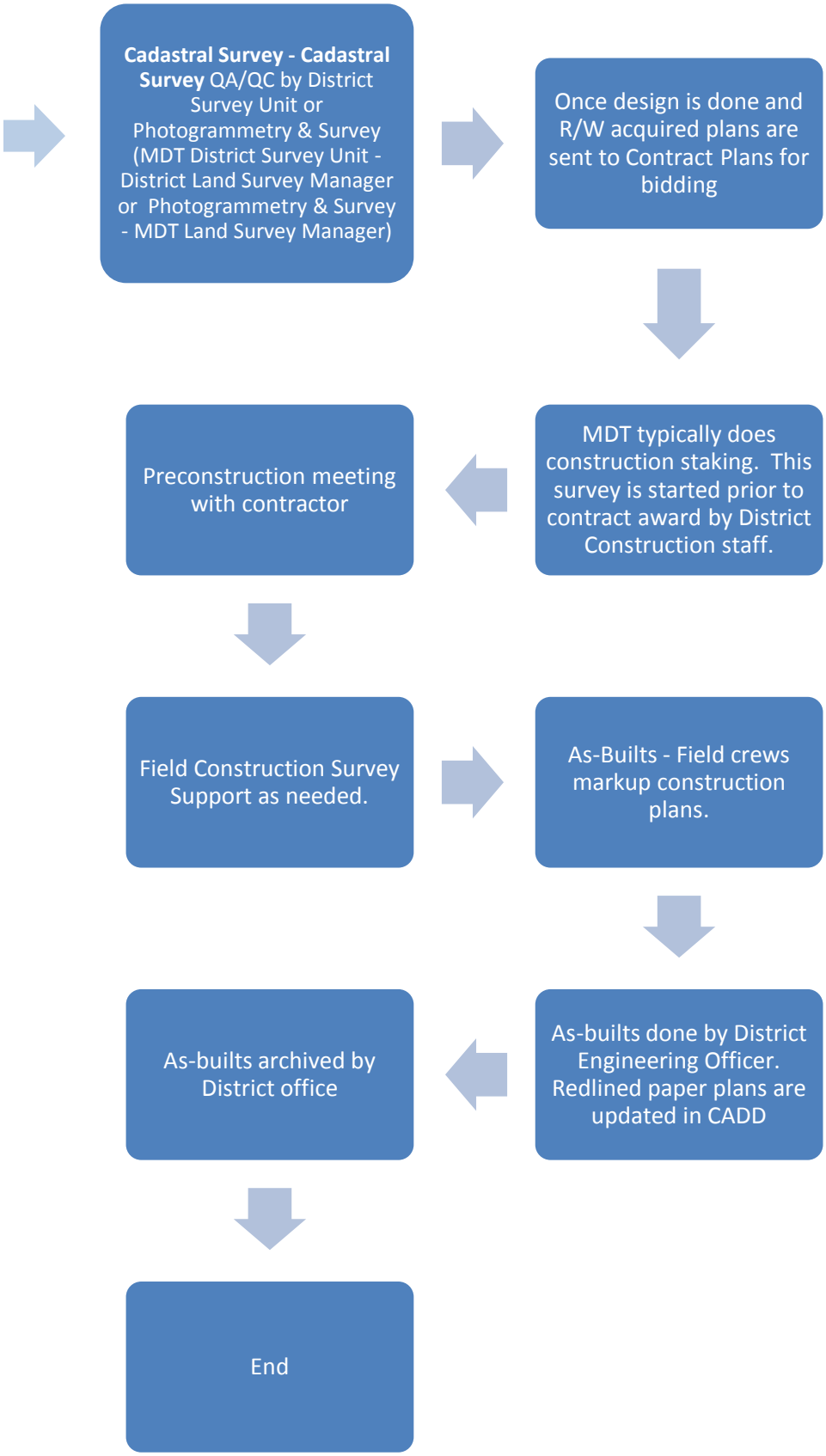
- PFR (Preliminary Field Review)
- Survey Request Form

End:

- MicroStation 2D and 3D files
- TIN files
- Point clouds
- Ortho photos
- Point list files
- Certificates of Survey
- Staking reports
- Misc. maps, reports, etc.
- Survey information for developing as-built

- **Current State Summary**
  - **Narrative**
    - Surveys are required by many Preconstruction and Construction projects. To initiate a survey, a Survey Request Form is submitted by requester. 3D survey data is collected and processed. The following survey types are performed: Control Surveys, Cadastral (ROW and Property), Topographic/Engineering, and Construction Surveys.
    - Conventional surveys are currently processed in the office using GEOPAK Survey software. A 3D MicroStation design file is created. A TIN model file, GPK file, and "points list" file are also created. There are well defined CADD standards for Survey. Completed surveys are put on DMS and notification is done using emails and memos.
    - Photogrammetry creates 2D and 3D MicroStation design files, ortho photos and TIN model files. The photogrammetry TIN model file is created by graphically extracting DTM features. Due to MicroStation/GEOPAK limitations only one DTM feature can be extracted at a time.
    - MDT Survey performs construction staking for many construction projects. Typically construction staking is started prior to contract award by District staff. Data is being manually entered in the data collectors from paper plans during staking. Independent as-built surveys of construction projects are not being performed.


Project Nominated and Assigned to Engineering Design Project Manager
Engineering Design Project Manager initiates the development of the PFR and survey request form (multiple groups involved)
OPX2 tasks established
Formal Start to Survey Process: Distribution of the PFR and Survey Request Form
Photogrammetry & Survey, District Survey and District Construction receive a copy of the survey request formEstabalish tasks with OPX2
Control Survey - Field Activities for Control Surveys Completed by Photogrammetry & Survey and District Staff
Control Survey - Control Survey Field Data Processed (office) by Photogrammetry & Survey or District Survey Unit
Control Survey - Control Survey QA/QC and Distribution by Photogrammetry & Survey (MDT Land Survey Manager)
Topographic/Engineering Survey- Field Activities for Topographic/Engineering Survey Completed (conventional/photo-grammetric)
Topographic/Engineering Survey- Topographic/Engineering Survey Data Processed (office)
Topographic/Engineering Survey- Topographic/Engineering Survey QA/QC and Distribution by District Construction (MDT District Construction office - District Data Collection Coordinator) (conventional) or Photogrammetry & Survey (photogrammetric)
Cadastral Survey - Field Activities for Cadastral Survey Completed
Cadastral - Cadastral Survey Data Processed (office)


Cadastral Survey - Cadastral Survey QA/QC by District Survey Unit or Photogrammetry & Survey (MDT District Survey Unit - District Land Survey Manager or Photogrammetry & Survey - MDT Land Survey Manager)
Once design is done and R/W acquired plans are sent to Contract Plans for bidding
MDT typically does construction staking. This survey is started prior to contract award by District Construction staff.
Preconstruction meeting with contractor
Field Construction Survey Support as needed.
As-Builts - Field crews markup construction plans.
As-builts done by District Engineering Officer. Redlined paper plans are updated in CADD
As-builts archived by District office
End

- **Technology**
  - The following Survey equipment is currently being used:
    - Laptops are used in the field but are not connected to the network. Cell tower reception is a challenge.
    - GPS/GNSS
      - Trimble R8s, R7s, 5700s
      - Trimble NetR5s, Net R9s
      - Spectra Precision EPOCH 50s
      - Various models of handheld receivers
    - Total Stations
      - Trimble S6s
      - Sokkia Set series
      - Topcon series
    - Levels
      - Trimble DiNi series levels
    - Data Collectors
      - TDS Rangers
      - Trimble TSC series
    - Other Survey
      - Leica C10 terrestrial scanner
      - Hydrolite hydrographic survey system
    - Photogrammetry
      - Leica DSW700 aerial film scanner
      - Leica RC30 aerial camera system
      - UltraCam Eagle aerial camera system

- No Geographic Coordinate System is being applied to the MicroStation design files. There is one NAD83 State Plane Coordinate zone for Montana.
- Montana has a sparse network of Continuously Operating Reference Stations (CORS) and there is no Real Time Network (RTN). Required elevation accuracies often cannot be obtained using GPS/GNSS survey methods. Development of an RTN, densification of the CORS along with improvements to the GEOID model would enhance MDT's GPS/GNSS survey capabilities.
- Control survey methods are determined by survey standards, project conditions, etc. Normally GPS/GNSS control surveys are used. GPS/GNSS control surveys are augmented with total station survey data when needed. Trimble software is used to compute GPS/GNSS survey data. Traverses are adjusted using GEOPAK Survey, StarNet, and Trimble software.
- One terrestrial LiDAR device is owned and used by MDT. The standards for LiDAR are still being developed by MDT. The LiDAR data is processed using Cyclone software. 3D MicroStation design files and TIN model files are created. Cyclone is being used to create 3D break line features and for point thinning. More storage space and network speed is needed for LiDAR files. Approximately one dozen helicopter and fixed wing LiDAR surveys have been flown by consultants. One consultant provided a mobile LiDAR survey and this is being used on a project.
- When changes are needed in construction, field crews' markup the paper construction plans. As-built plans are created by the District Engineering Officer. Redlined paper plans are updated in CADD.

- **People**
  - Surveys attend yearly training.

- **Identified areas of improvement**
  - There are well defined CADD standards for Survey. There are survey processes the MDT feels could be improved upon.
  - Data is being manually entered in the data collectors from paper plans during staking.
  - Independent as-built surveys of the construction projects are not being performed.
  - Due to MicroStation/GEOPAK limitations, the photogrammetry TIN model file is being created by importing one DTM feature at a time.

- Computer network and storage improvements needed to handle large amounts of remote sensing data.
- Improved efficiency in GPS/GNSS survey methods through CORS/RTN densification/development and GEOID model improvements.

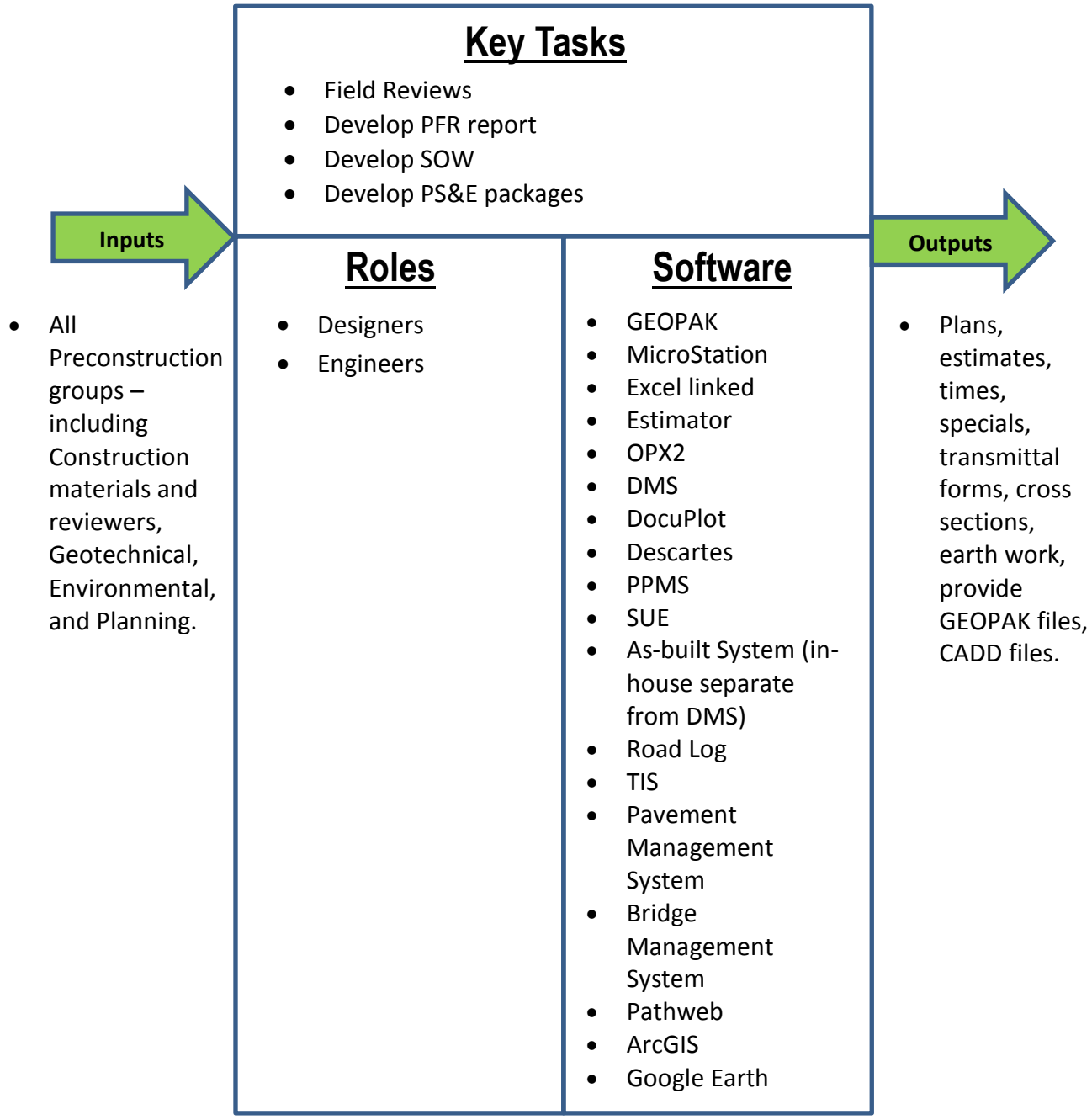
- **Identified areas of 3D Impact**
  - All deliverables should be 3D.
  - Staking process and modification to design model for handover to contractor
  - As built approach
  - Project Management System (OPX2) – task definition.
  - Impact on AASHTOW are SiteManager for pay items.

- **Expected / State Benefits using 3D Models**
  - Less manual input.
  - Safety for the surveyor
  - Less work in the field
- **Software**
  - Air Photo, Photogrammetry & Survey
    - Microsoft Office
    - MicroStation
    - GEOPAK
    - Descartes
    - Air-Photo Proj Dir Creation
    - Photo Proj Dir Creation
    - Survey Proj Dir Creation
    - Corpscon6
    - Snipping Tool
    - PDF 995
    - Roxio
    - Adobe Reader
    - Notepad
  - Air Photo & Photogrammetry
    - Cardinal Systems VR Mapping Software Modules
    - POSPac
    - Track'Air
    - UltraMap
    - Socet Set
    - Pro600
    - Image Equalizer

- Scan
- TerraModeler
- IrfanView
- GIMP 2
- Arc GIS Desktop
- Bulk Rename Utility
- Mr Sid Viewer (I believe the Win7 version is called GeoViewer)
- WS_FTP
- Daminion
- QVT Term
- WS_FTP Pro

- Air Photo Only
  - Adobe Photoshop (CS6)
- Survey Only
  - WINCMM (Cadastral Measurement Management)
  - Cyclone
  - CloudWorx
  - Star*Net Plus
  - Corpscon6
  - Triad
  - Star*DiNi
  - Star*Geoid
  - Star*Net
  - Star*TDS
  - Trimble Access
  - Trimble Business Center
  - Trimble Survey Controller (on older equipment)
  - Trimble Data Transfer
  - Trimble ASCII File Generator
  - TDS Survey Pro
  - MicroSurvey StarNet7
  - Convert to Rinex
  - MyMobiler
  - Spider

Group Name: Road Design Section
Process Name: Road Design



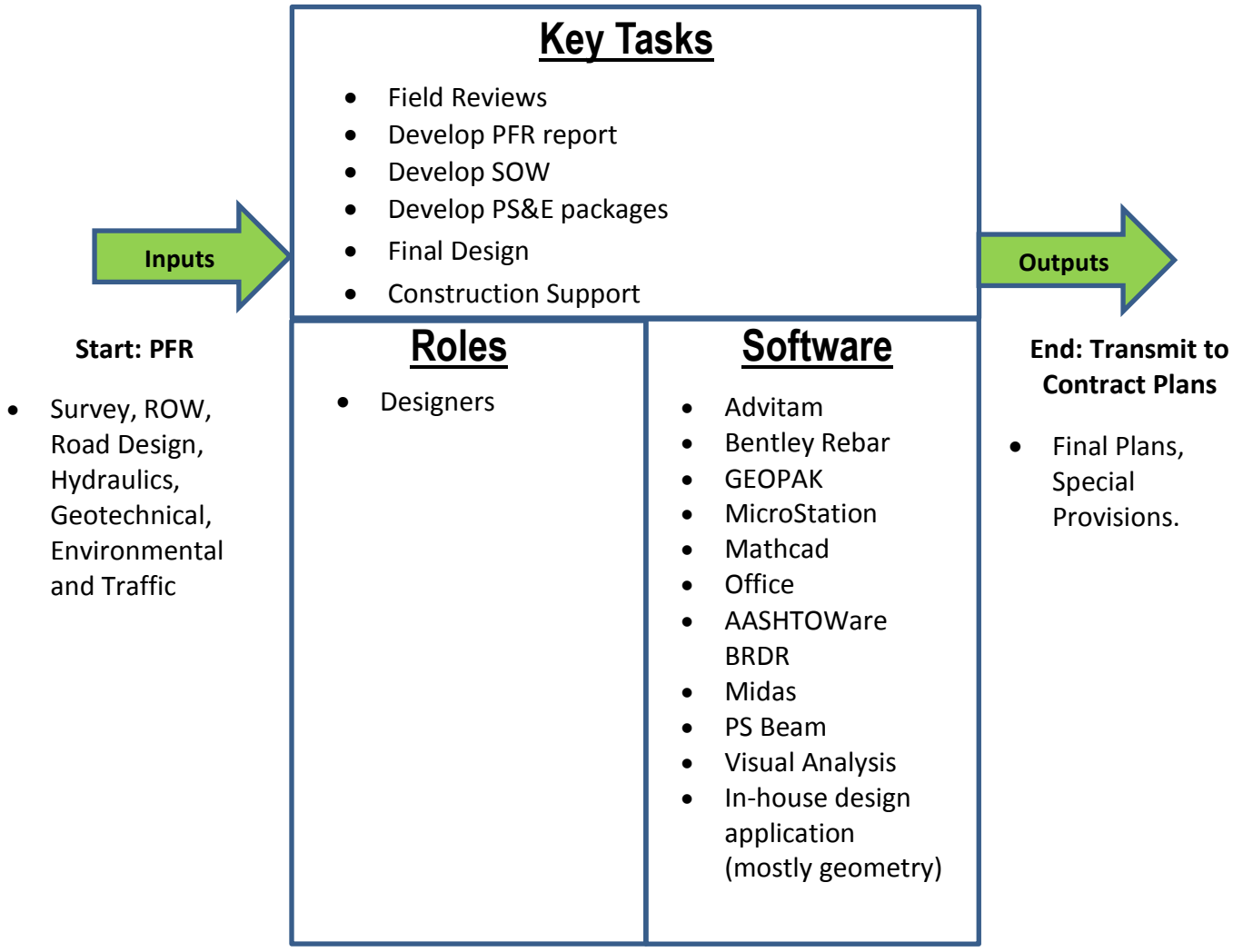
Current State Summary

- **Process**

- **Technology**
  - Five people are using OpenRoads in Helena.
  - Some usage of 3D LiDAR to produce 2D design.
  - General consensus is that most projects are 2D.
  - Some Districts are using the Roadway Designer in GEOPAK to create 3D models.
  - Some folks are using GEOPAK Site to provide 3D TIN models.
  - Road Design has some experience with design visualization.
  - LiDAR is used for detailed information to design ADA ramps.
  - Point Clouds are used to get design information (coordinates and elevations). No terrain models created.
  - One LiDAR project was used to create a 3D terrain model.
  - Road Design is piloting OpenRoads, a new Document Management System, and new plotting system. The Subsurface Utility Engineering software is also being investigated.
  - Road Design had well defined at one time. The published standards don't always match the standard.
- **People**
  - Road Design staff attends GEOPAK Criteria SS2, OpenRoads, and basic MicroStation 3D training. Every 6 months, a MicroStation class is offered (includes basics of DMS). Most of the training is "on-the-job" training. MicroStation is generic training (each discipline provides training on specifics). There is no dedicated training staff at MDT. MicroStation training is 32 hours. GEOPAK training is 16 hours. GEOPAK training will likely be 40 hours in the future.

- **Identified areas of improvement**
  - Road Design uses Grid coordinates and Bridge Design uses Ground coordinates.
  - Some users are using GEOPAK SS4 and the rest are using GEOPAK SS2.
  - The LiDAR file sizes are large.
  - The MicroStation Line Style scales are not always correct.
  - Multiple CADD standard servers are producing different views.
  - There are MicroStation Level management issues (possible CADD standards issues).
  - There is a challenge with survey with cells not the correct size and location (CADD standards issues or survey practices).
  - Referencing using plotting workflow.
  - Have to take plans and manually enter the data into different software for staking.
  - Need to have certain features surveyed and automatically put in cross sections.
  - Need a seamless transition between design and construction.
  - Need more CADD macros and fine tune existing CADD macros.
  - Better utilization of software.
  - More efficient as-built process (currently is as-let with quantity changes).
  - Need automate estimates.
  - DMS and scheduling software needs an automated updates of changes. Drawings change alerts to others is needed.
  - When we have a change to plans, the profile must be manually redone.

Group Name: Bridge Design Section
Process Name: Bridge Design



Start: PFR

- Survey, ROW, Road Design, Hydraulics, Geotechnical, Environmental and Traffic

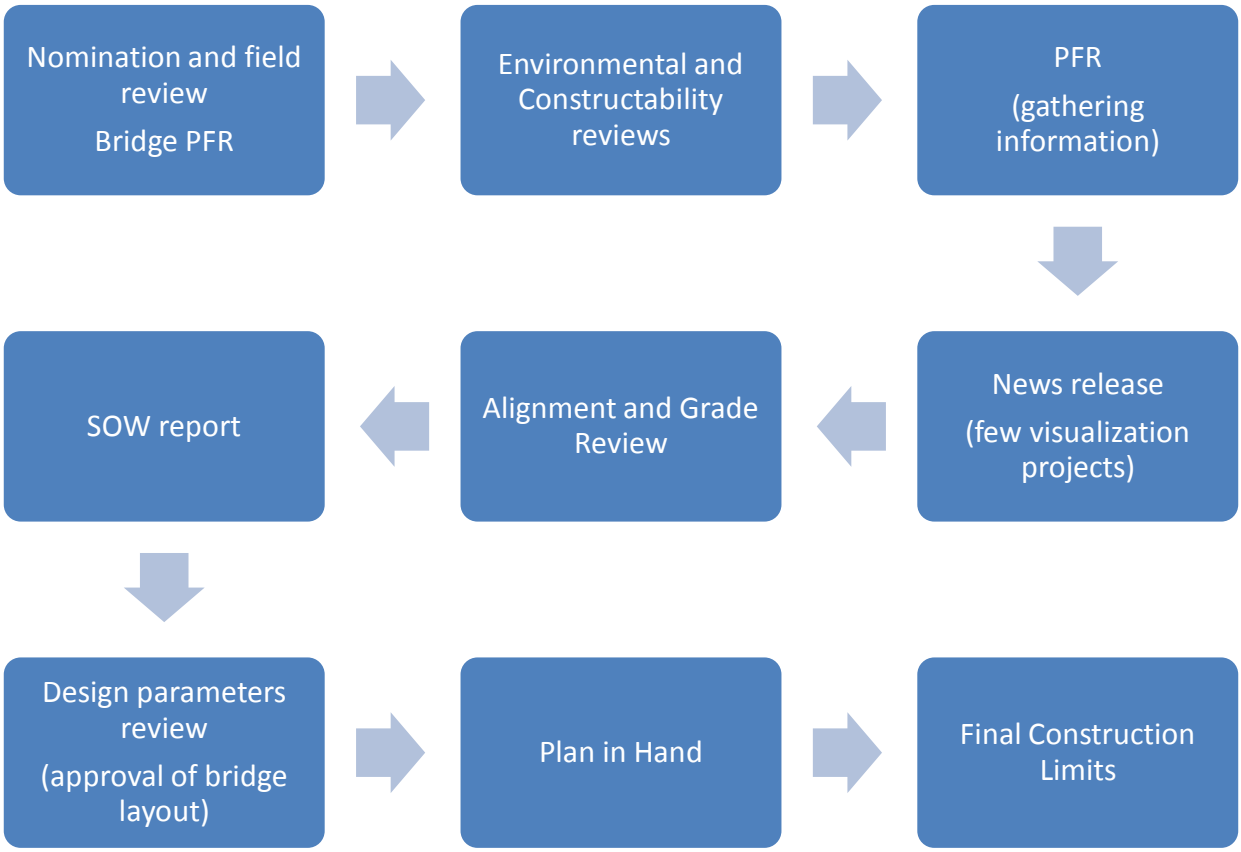
End: Transmit to Contract Plans

- Final Plans, Special Provisions.

Current State Summary

- **Process**

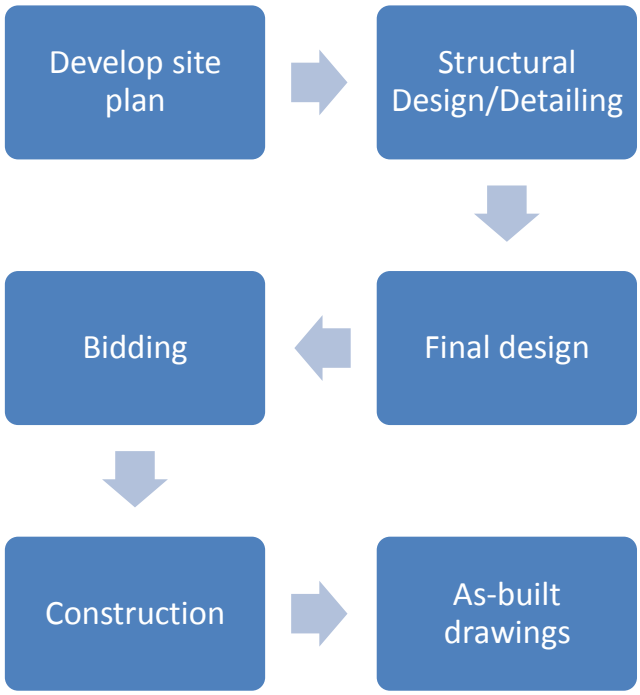
Milestones



Involved Groups

- Survey, ROW, Road Design, Hydraulics, Geotechnical, Environmental, and Traffic

Workflow



Other Information

- Bridge Replacement – takes 4 to 6 years (usually complete 6 per year).
- Mostly bridge rehab projects.

- **Technology**
  - Has experience using basic 3D solid modeling for visualization purposes.
  - Some LiDAR surveys are being using during bridge design.
  - 3D models would help to determine bridge clearance is a possible 3D modeling benefit identified by the group.
  - In the process of investigating AASHTO Bridge Design and Rating software.
  - Bridge Design has well defined CADD Standards.

- **People**

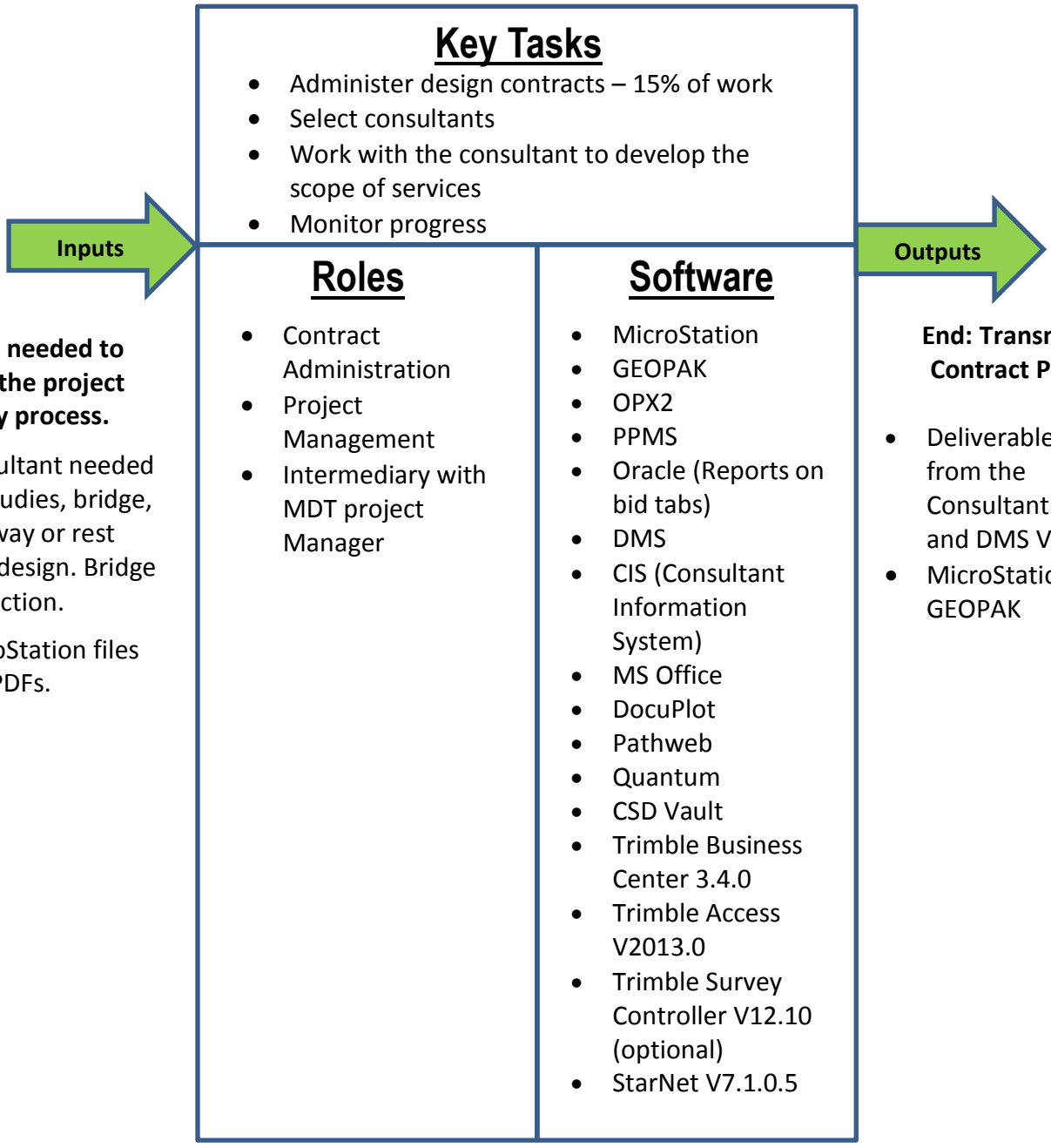
- Bridge Design training includes Introduction and Intermediate MicroStation training. Also, they attend Introduction to GEOPAK training. On-the-job Mentoring is commonly conducted. Functions needed for training are: cutting cross sections, coordinate geometry (.gpk file), Terrain Modeling (TIN), contours and alignments.
- Bridge Design has representation on the MDT CADD Users Group, AASHTO, and AASHTO T18 (subcommittee to SCOBS).

- **Identified areas of improvement**
  - Interface of the linear project of the road and site project for the bridge is a challenge.
  - Bridge layout is complicated by the fact that Bridge Design uses ground coordinates and Road Design uses grid coordinates.
  - Project management scheduling is a challenge.
  - Creating the site plan for resource agencies is a challenge.
  - Plotting is a challenge because plotting is based on Road Design standards.
  - Can't take boring logs from gINT into MicroStation.
  - Need better survey accuracy near railroad crossings.

- **Identified areas of 3D Impact**
  - Internal review process
  - discipline coordination
  - deliverables to contractors
  - Inspection process
  - As-built process

- **Expected / Stated Benefits using 3D Models.**
  - Site plan development for layout, interaction with resource agencies and construction
  - Visualizing the design
  - Understanding coordinate geometry
  - Conflicts in rebar
  - Bridge inspection
  - Clash detection

Group Name: Consultant Design Bureau
Process Name: Project Delivery – External Support.



Start: As needed to support the project delivery process.

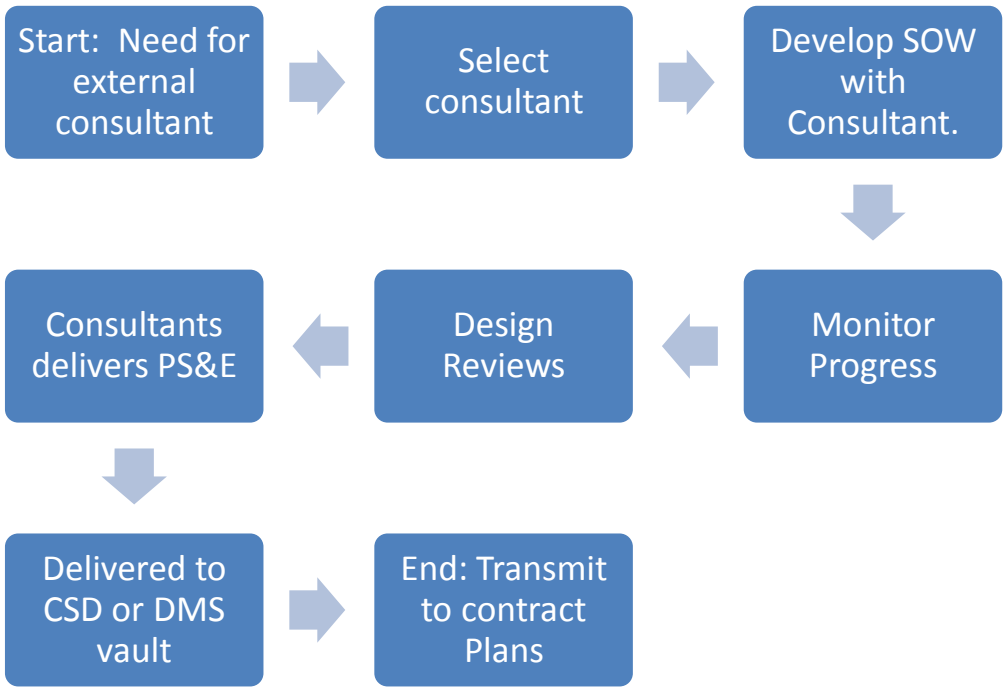
- Consultant needed for studies, bridge, highway or rest area design. Bridge inspection.
- MicroStation files and PDFs.

End: Transmit to Contract Plans.

- Deliverables (PS&E) from the Consultant via CSD and DMS Vaults.
- MicroStation and GEOPAK

Current State Summary

- **Process**



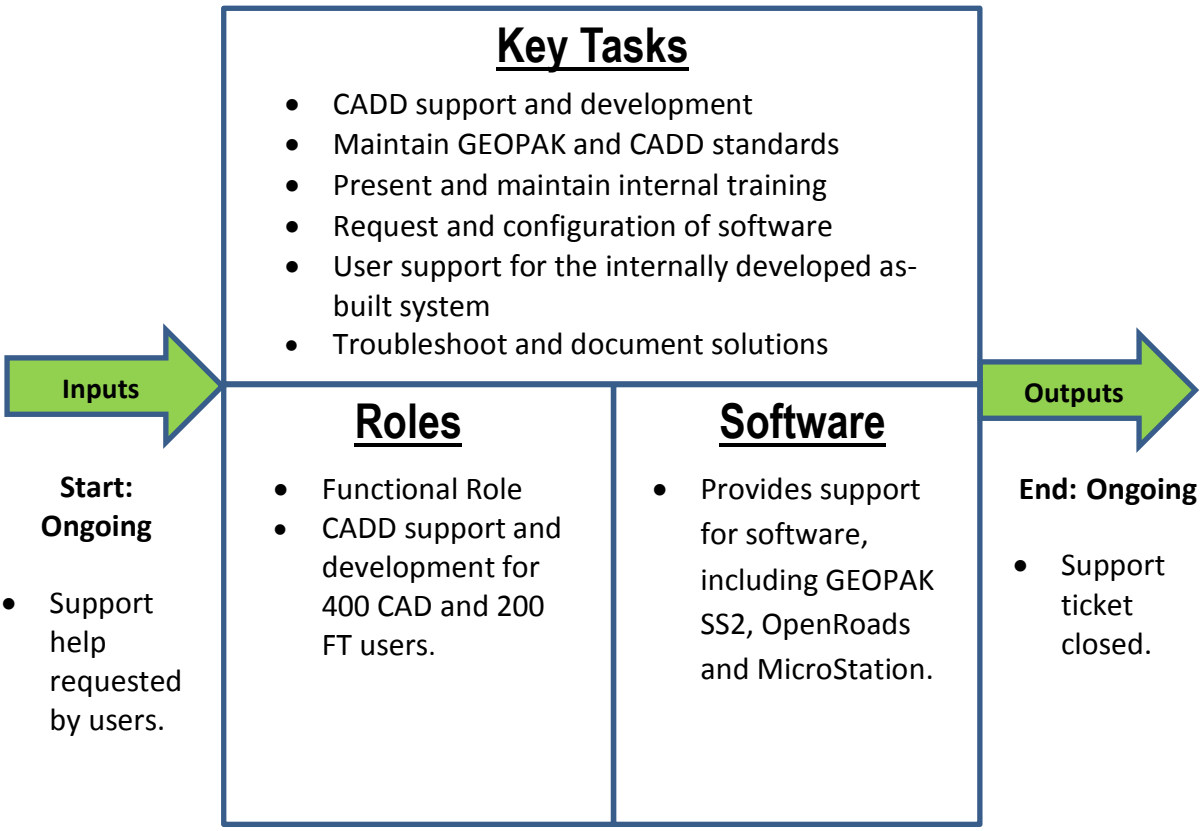
- **Technology**
  - MDT provides consultants the following data: Design strip map, TIN files, .gpk files, working cross sections, and earthwork files.
  - Very little work is done using 3D models.
- **People**
  - N/A for the consultants
  - Limited knowledge of 3D by Consultant Design Bureau.
- **Identified areas of improvement**
  - Communication with Design team (in- house and consultants). Scoping, (including budget) reviewing and approving.
  - Getting recommendations from Consultants back to MDT.
  - What will it take to scope 3D models and estimates? This will be a challenge.
  - Consultant industry is ahead of them with the software they are using.

- File Management is a problem and there are future challenges with 3D and LiDAR files.
- Compatibility of software is sometimes a problem. Plotting drawings (they don't plot the same as delivered paper plans).
- Have to rename files to put on DMS.
- File size for LiDAR files. File naming conventions.

- **Identified areas of 3D Impact**
  - Use of 3D data for visualization
  - Standardization of deliverables to and from consultants
  - Design and Constructability Reviews
  - Training for MDT staff

- **Expected / Stated Benefits Using 3D Models**
  - Allow visualization and problem solving of design elements.
  - Enable photo draping; automated quantity take-off; automatic rendering; auto-animation

Group Name: Engineering Information Services Section
Process Name: MDT Project Delivery Support



Current State Summary

- **Functions**
  - CADD support and development – department wide GEOPAK SS2, OpenRoads and MicroStation.
  - Maintain GEOPAK and MicroStation standards.
  - Training – MicroStation and GEOPAK SS2 training.
  - Request and configuration of software (ISD does the installation). Based on standards. (Altiris is used to install software)
  - User support for the as-built system.
  - Note: ISD supports the home built systems – DMS, DocuPlot and As-built sys.
  - User issues go to EISS.
  - Troubleshoot and document solutions for GEOPAK, MicroStation, OpenRoads, Roadway designer, Descartes etc.…
  - Point of contact to Bentley.
  - Help sheets for users.
  - Run user group meetings.
  - Coordinate test user groups.
  - Communication of CADD news to users.
  - Create and maintain macros.
- **Technology**
  - Work closely with design teams to understand their standards requirements.
  - Each area has a person that maintains their CADD standards.
  - Each group has their own cell libraries, standard details, and provides them to CADD support for posting. Submit a ticket to CADD support post their changes.
  - Request levels, seed files, macros, from CADD support.
  - Workspaces: CADD Dev, CADD Test, CADD Standards, Dev OpenRoads, Test OpenRoads
  - Need standards for delivering 3D models to contractors.
  - Hardware specification:

Hewlett-Packard
HP Z220 SFF Workstation

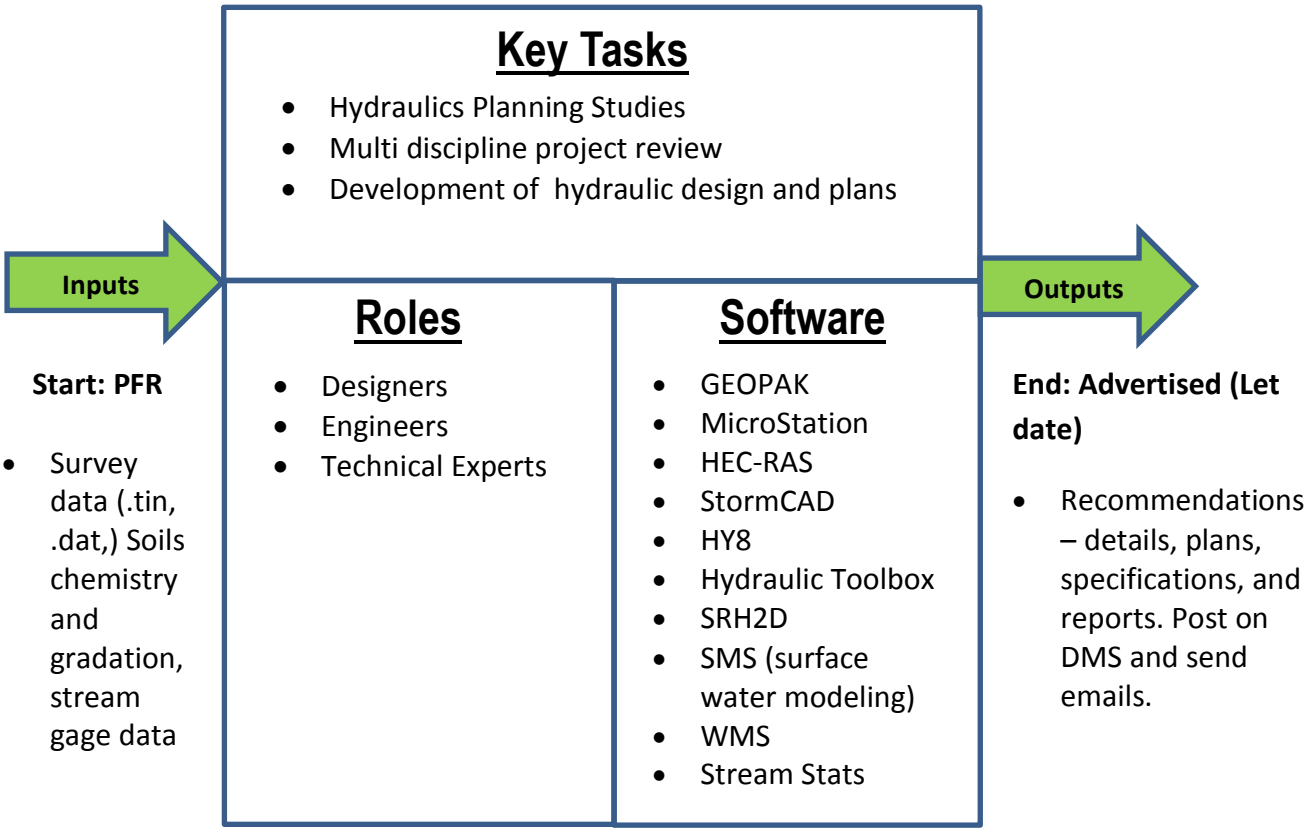
OS: Microsoft Windows 7 Enterprise
System Type: x64-based PC
Processor: Intel(R) Core(TM) i7-3770 CPU @ 3.40GHz, 3401 Mhz, 4 Core(s), 8 Logical Processor(s)
Installed Physical Memory (RAM) 16.0 GB

CD-ROM Drive
DVD Writer
DVD A DH16ACSHR SCSI CdRom Device

Drive C:
Description Local Fixed Disk
Compressed No
File System NTFS
Size 148.95 GB
Free Space 91.63 GB

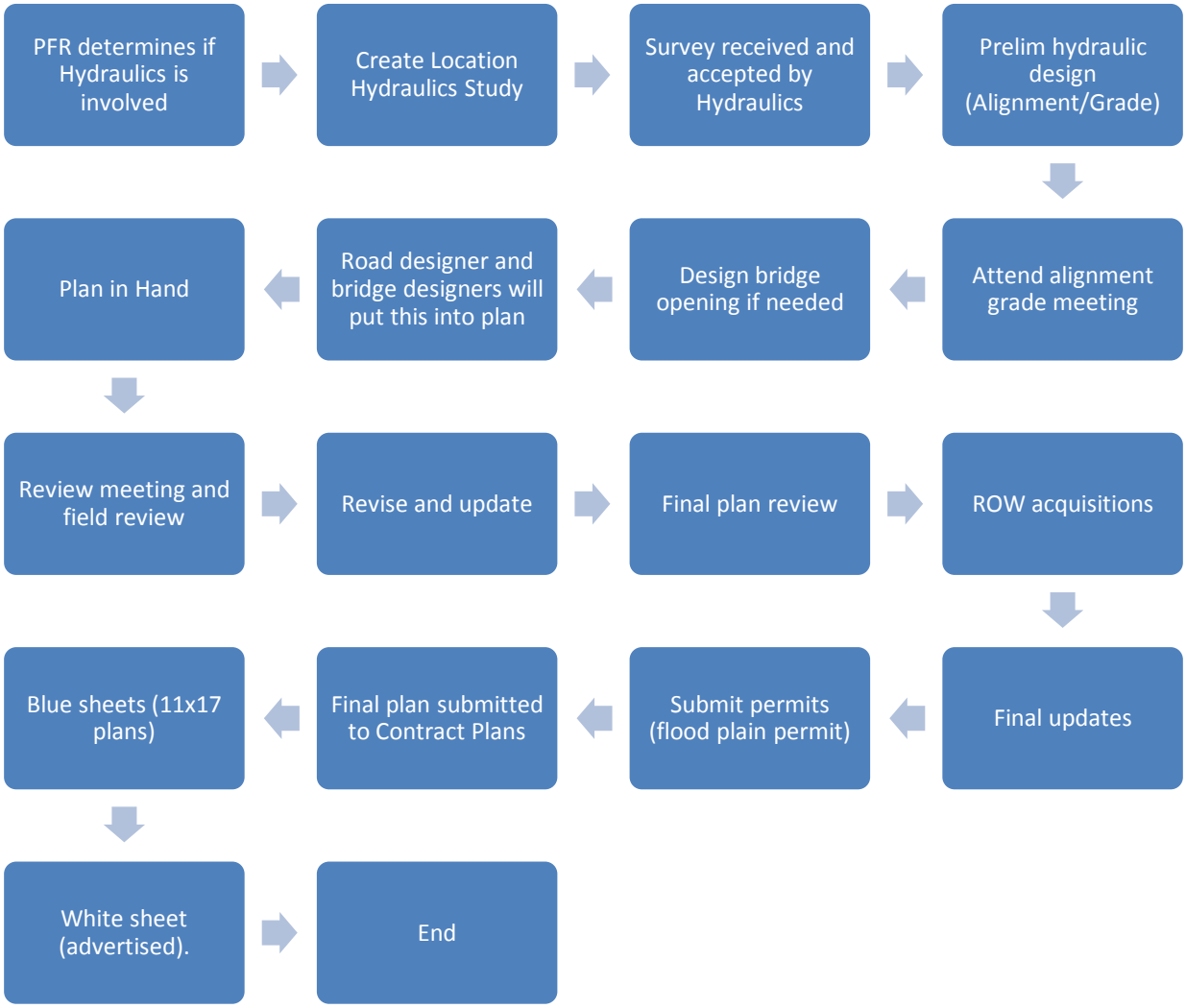
- **People**
  - Limited 3D knowledge.
- **Identified areas of improvement**
  - Stability of SS4 right now (Still not stable as of 11-25-15)
  - Maintaining SS2 and SS4 workspaces and standards.
  - Attracting competent staff.
  - In house developed applications.
  - Workgroup in three different geographic locations.
  - Blurred line between ISD and CADD support.
  - Tracking of work in department.
- **Identified areas of 3D Impact**
  - CADD Standards for all disciplines
  - Develop Training materials
    - OpenRoads 3D Modeling
  - CADD Support
  - In-house applications
    - Need to review and determine need for the macros currently maintained.

Group Name: Hydraulics Section
Process Name: Project Delivery – Hydraulic Design



Current State Summary

- **Process**

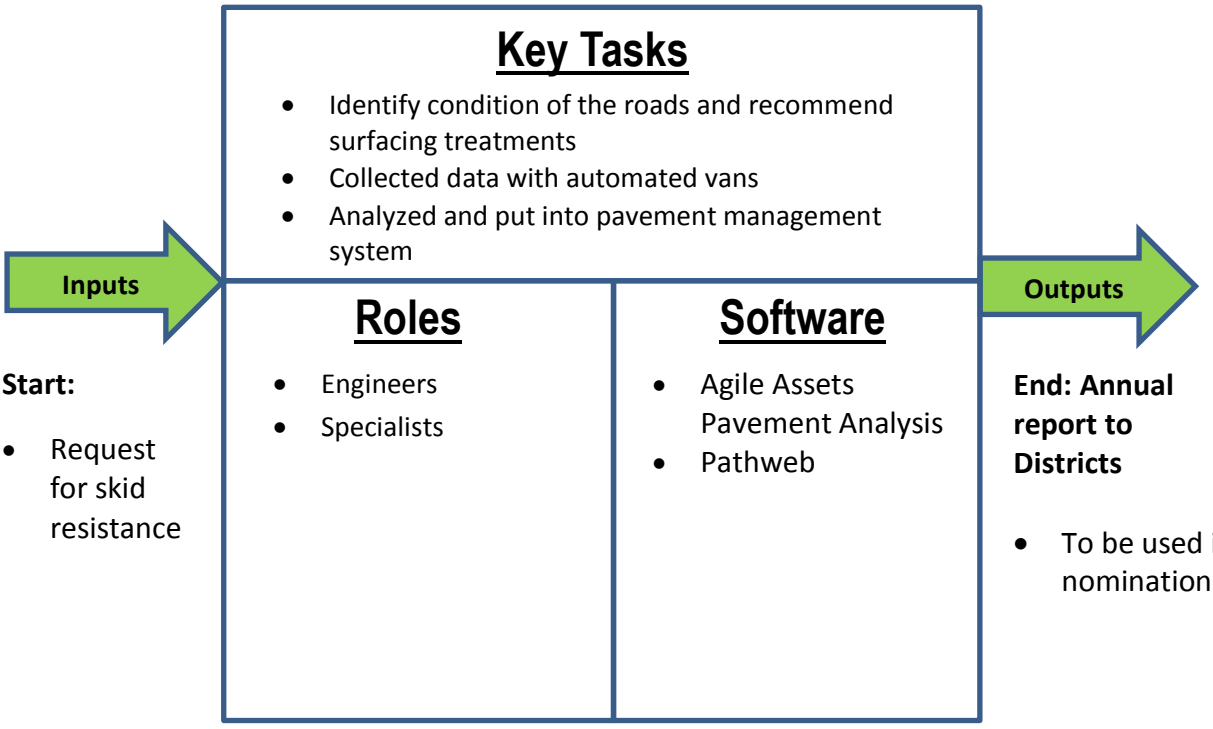


- **Technology**
  - Rational, USGS regression equation (mainly using), HEC 22, and SCS are used for hydrology.
  - Hydraulic modeling rivers and floodplains in 1D and 2D utilizing LiDAR, photogrammetry and ground survey.
  - Utilizing Bentley StormCAD for storm drain design.

- **People**
  - Training for MicroStation and Terrain Model (TIN) is attended. NHI courses (hydraulic issues), and FHWA courses are also attended.

- **Identified areas of improvement**
  - Making sure survey is good. Terrain Model (TIN) needs to be in good condition.
  - Need more ground shots. Need higher accuracy.
  - Hydraulics maybe developing MicroStation map files with drainage features, but the designer may not use that. Road Design is drafting the drainage features in the plans using their hydraulic recommendations.
  - Survey requests are not standardized between Districts.
  - Could use additional training for Bentley products such as StormCAD and PondPack.
- **Identified areas of 3D Impact**
  - Survey acquisition specification
  - Design delivery (data) between disciplines
  - Project Delivery and Review procedures
- **Expected / Stated Benefits using 3D Models**
  - Better understanding of drainage patterns and therefore better hydraulic designs especially for roadway and roadside drainage.

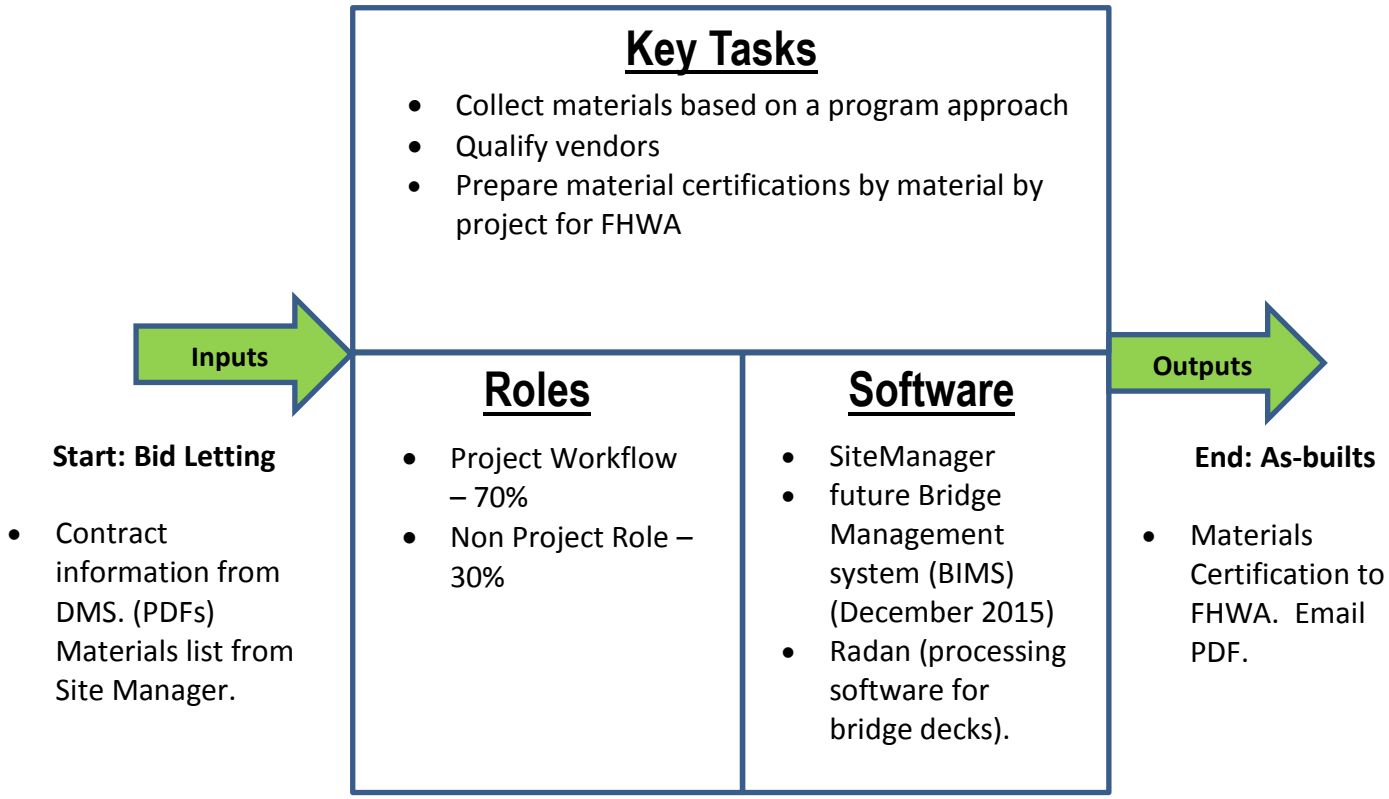
Group Name: Pavement Analysis Section
Process Name: Pavement Analysis



Current State Function Summary

- **Function**
  - Input: it is a cycle – request for skid resistance.
  - Identify condition of the roads and recommend surfacing treatments (each lane it captured one at a time).
  - Note: Map 21 – could potentially impact the analysis from 10 to 100 percent – may impact business process – HPMS submitted by planning via access to this data.
  - Collected data with automated vans.
  - Analyzed and put into pavement management system.
  - Output: Annual report to districts to be used in nominations.
  - Video Log – ISD (GIS group) Pathweb.
- **Identified areas of 3D Impact and Improvement**
  - Building a collection file from a road log.
  - Need more access to the reports that are generate by specific functions (don't have access to everything that is done by one person).
  - Access based on role rather than individual.

Group Name: Physical Testing Section



Start: Bid Letting

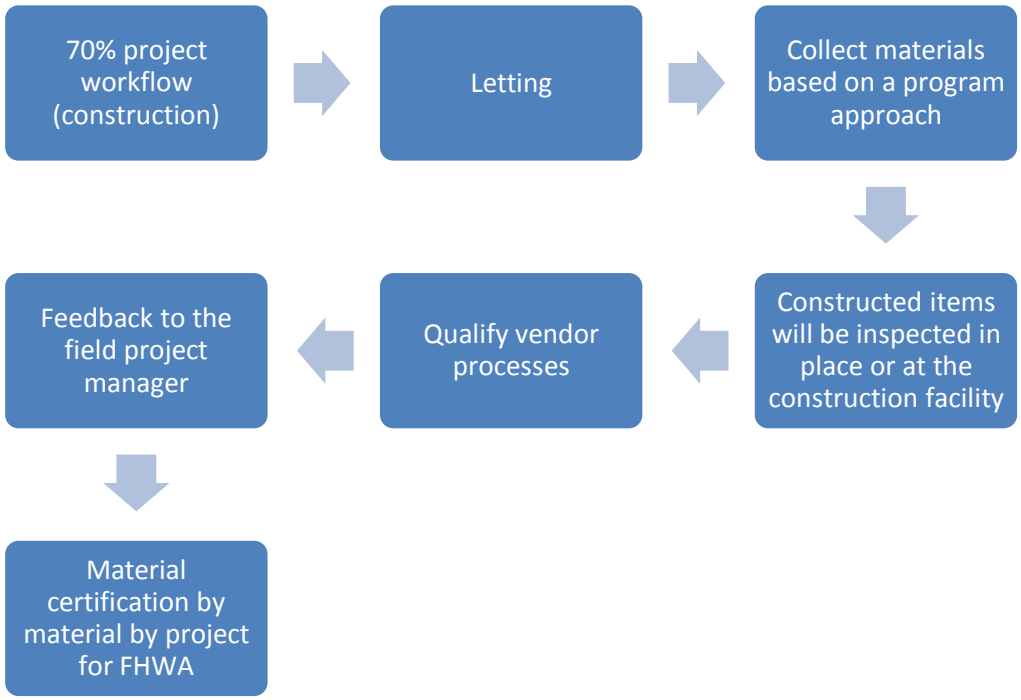
- Contract information from DMS. (PDFs) Materials list from Site Manager.

End: As-builts

- Materials Certification to FHWA. Email PDF.

Current State Summary

- **Process**



Non-project Functions (30%)

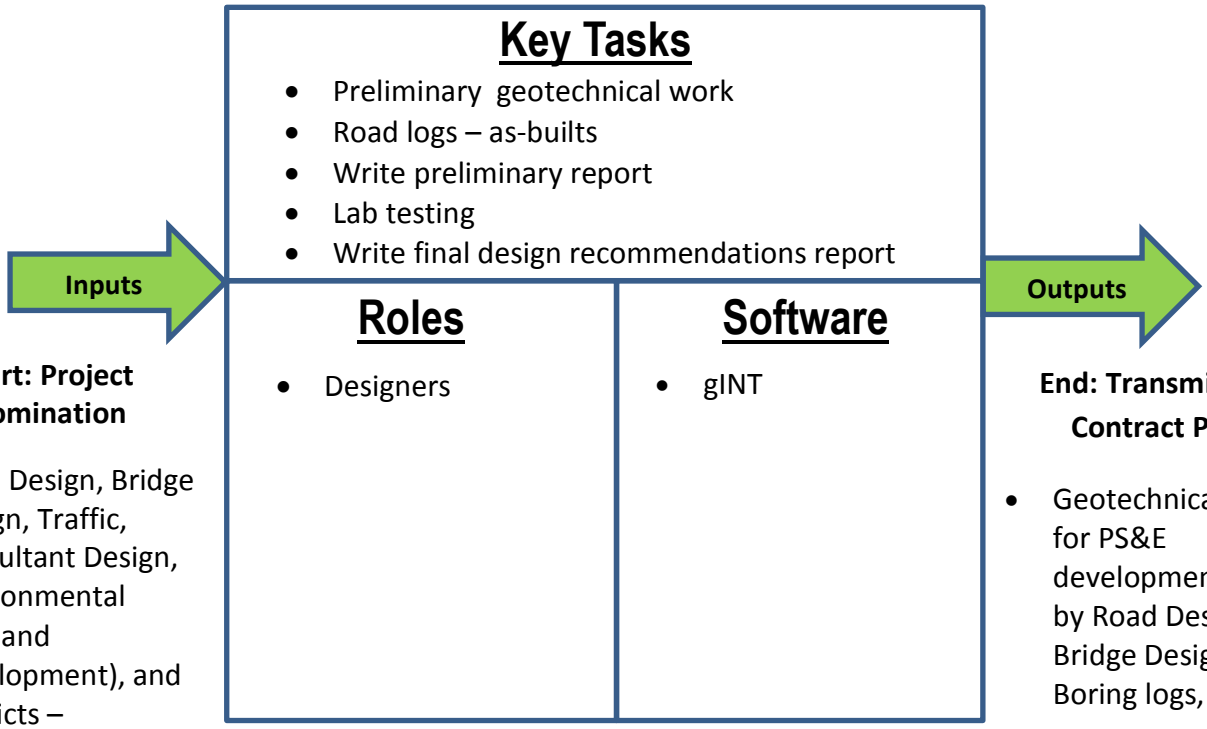
- GPR on bridges based on Bridge Design requests.
- Preconstruction samples.

- **Identified areas of improvement**
  - Using a preconstruction and construction testing results/data are not geospatially referenced.
  - Data can't be searched by location.
  - Don't have access to current plans and change orders. Change order resides in Site Manager.
  - Construction and preconstruction records are not in sync.
  - Instruments are not networked, so transfer is done by thumb drive or re-entering data by hand.
  - Can't access parts on Site Manager.
  - Sample Tracking is turned off.

- **Identified areas of 3D Impact**

- Limited 3D Impact. None stated. Possible areas to investigate:
  - Need access to 3D models in the field and office?
  - Need training on viewing 3D models including intelligence?
  - Need access to bridge information in the field?

Group Name: Geotechnical Section
Process Name: Geotechnical Engineering



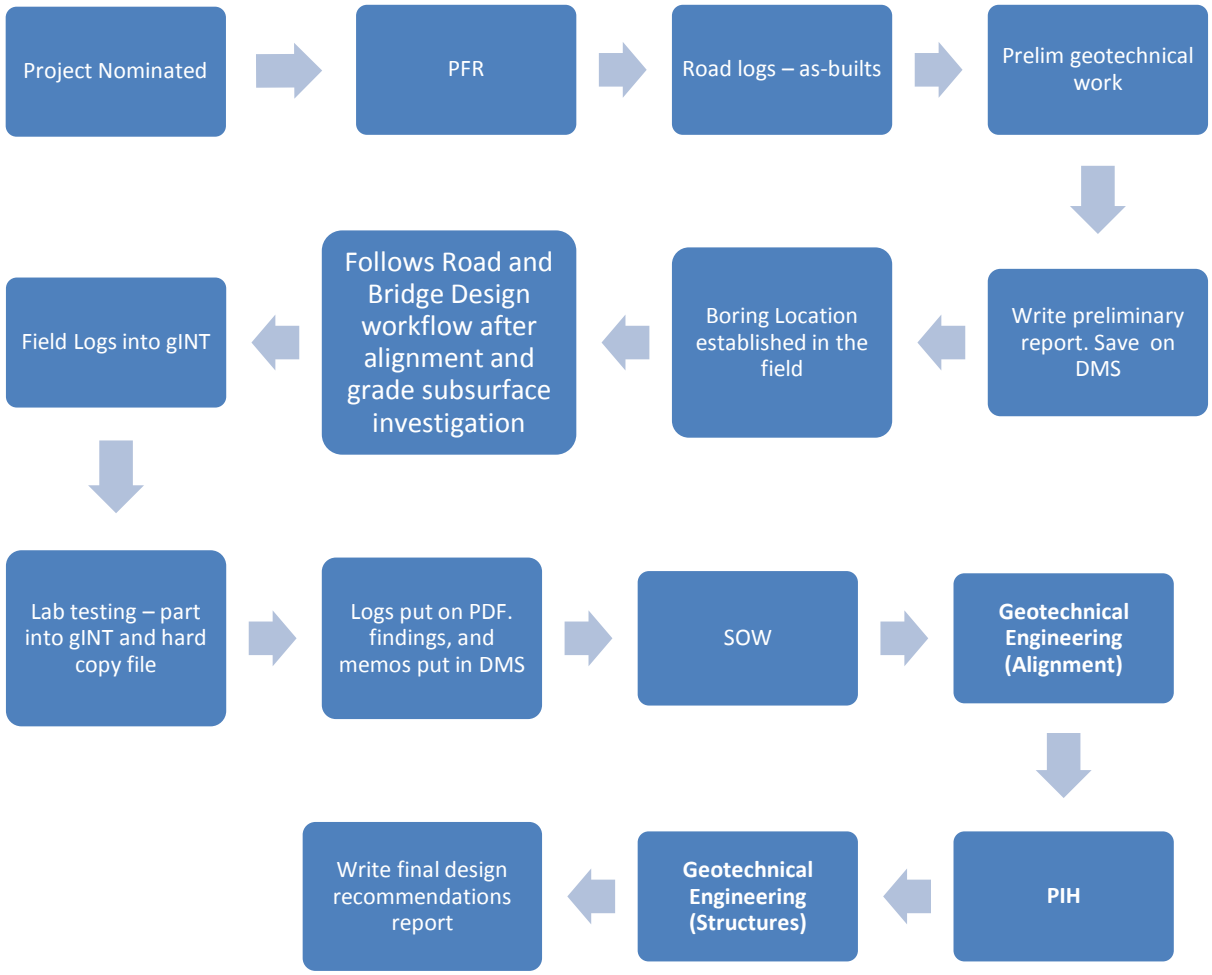
Start: Project Nomination

- Road Design, Bridge Design, Traffic, Consultant Design, Environmental (wetland development), and Districts – preliminary plans (PDF)
- Project development.

End: Transmittal to Contract Plans

- Geotechnical reports for PS&E development done by Road Design and Bridge Design. Boring logs, etc.

- **Current State Process Summary**



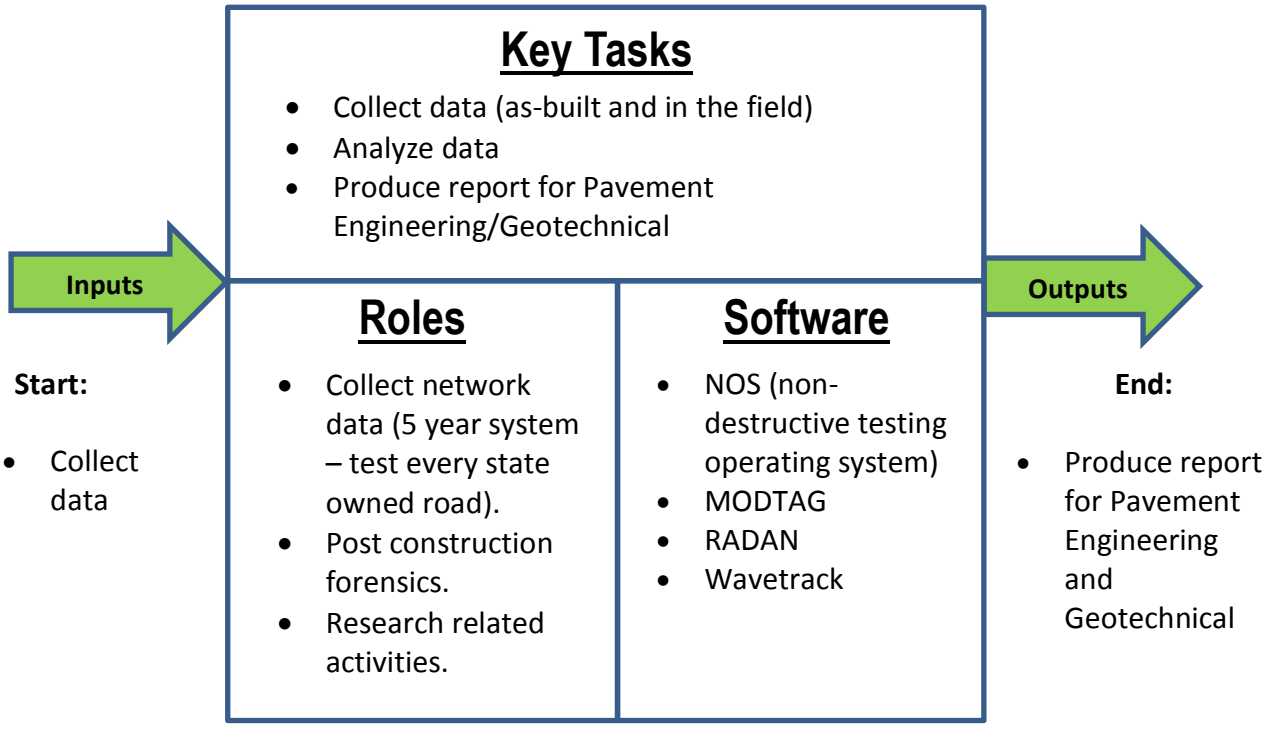
  - **Technology**
    - Prior experience using LiDAR for landslides and rock slopes.
  - **People**
    - Limited 3D Model experience.
  - **Identified areas of improvement**
    - Sometimes they get a CADD file or survey that they can't use.
    - Having challenges transferring device data to the network (lab data and field monitoring data).
    - Notes are taken in the field and then manually entered into gINT.

- Need remote data acquisition for field instrumentation.
- Getting design recommendation into plans (no CADD capability).

- **Identified areas of 3D Impact**
  - Data handoff from Preconstruction to Geotechnical Section (slope shading, contours, etc. vs. cross sections)
  - Subsurface material modeling

- **Expected / Stated Benefits using 3D Models**
  - Possible 3D modeling benefits identified by the group: slope stability from models; represent complex 3D design issues accurately for design and bidding; riprap layout (Bridge Design indicated this too); needed for retaining walls and tunnels.

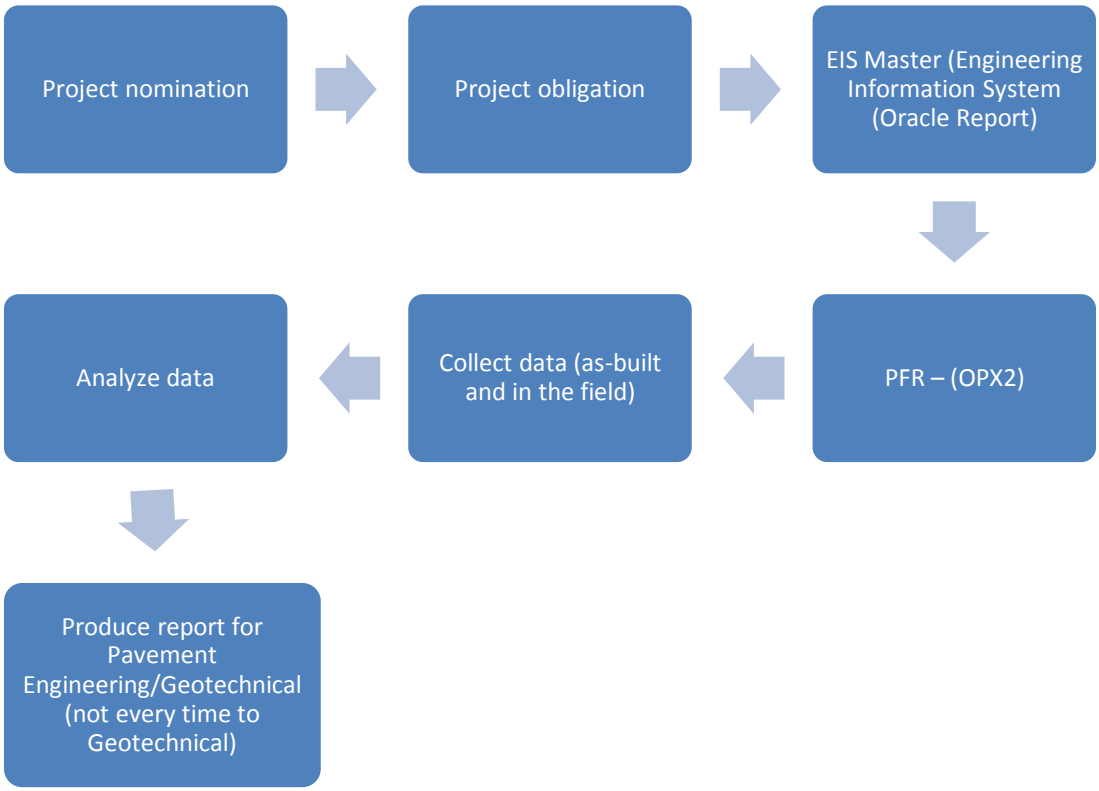
Group Name: Materials Bureau - Non-destructive Testing Unit
Process Name: Non-destructive Testing



Current State Summary

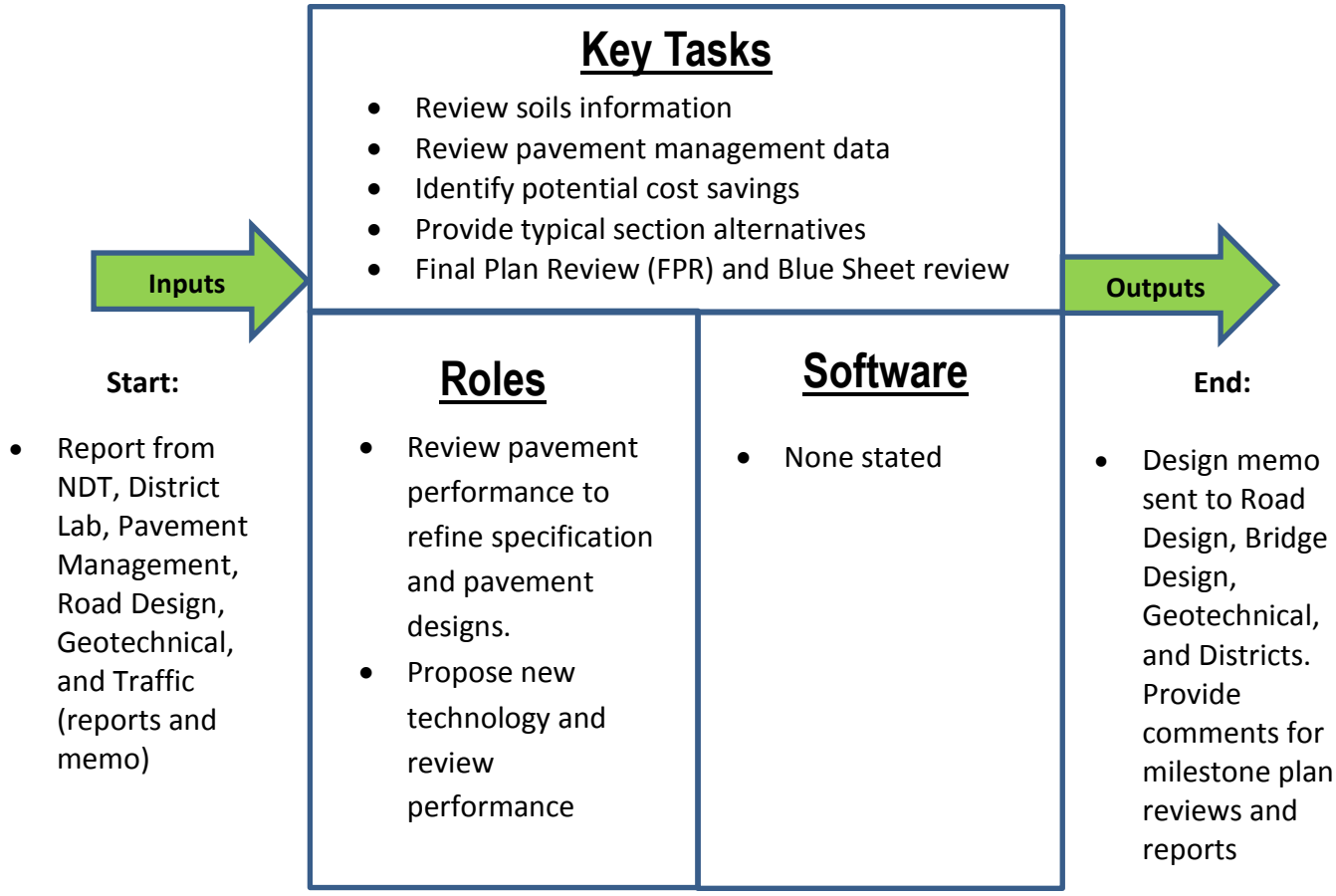
- **Process**

Project Workflow



- **Technology**
  - Falling Weight Deflectometer (FWD).
  - GPR (Ground Penetrating Radar).
- **People**
  - Limited 3D knowledge
- **Identified areas of improvement**
  - Have to cover a lot of road miles. Need further detail from MDT on this stated improvement.
  - No additional information available at the beginning of project. Need further detail from MDT on this stated improvement.
- **Expected / Stated Benefits of using 3D Models**
  - Better as-builts.

Group Name: Pavement Engineering Unit
Process Name: Pavement Engineering



Start:

- Report from NDT, District Lab, Pavement Management, Road Design, Geotechnical, and Traffic (reports and memo)

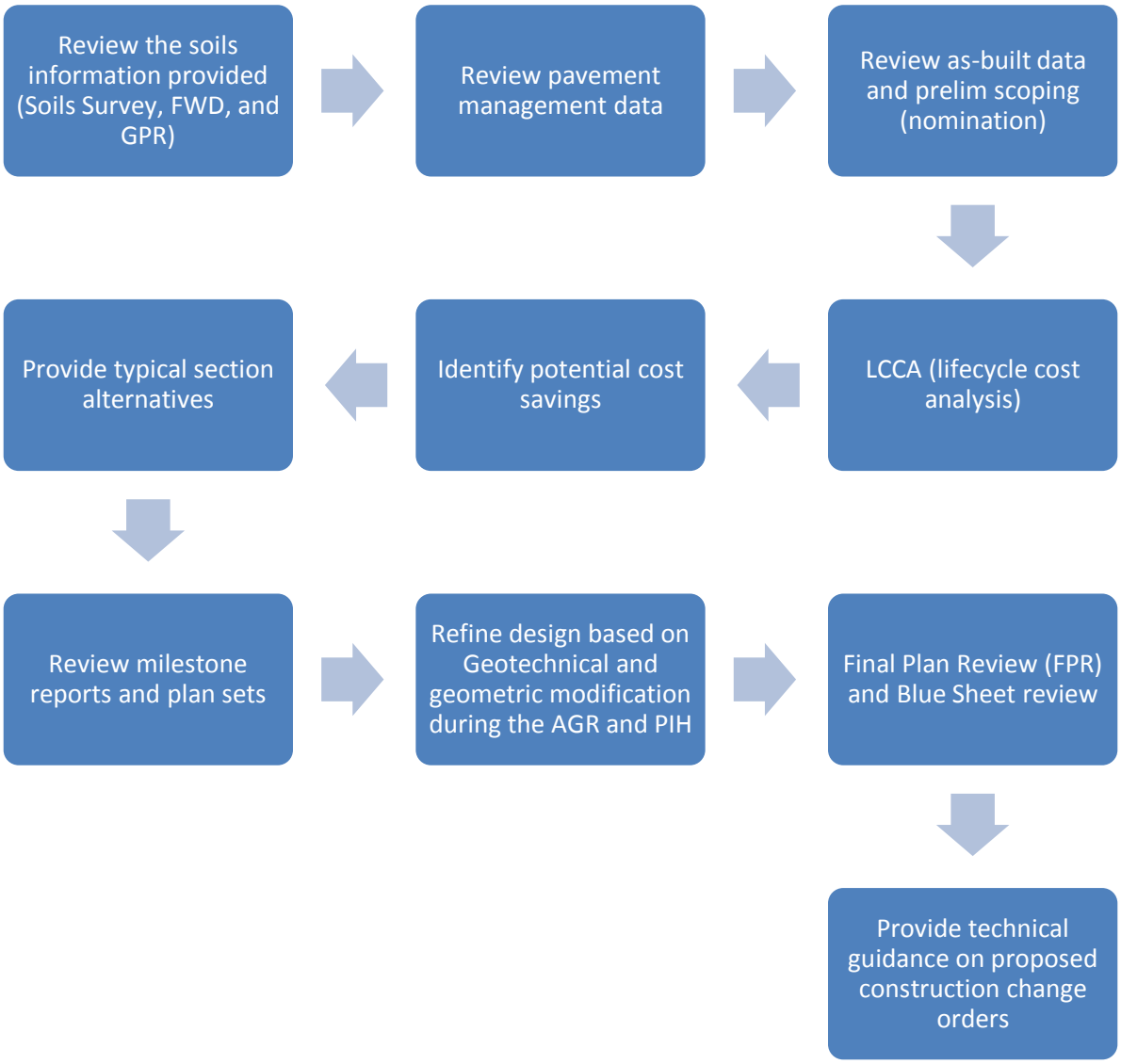
End:

- Design memo sent to Road Design, Bridge Design, Geotechnical, and Districts. Provide comments for milestone plan reviews and reports

Current State Summary

- **Process**

Project Workflow

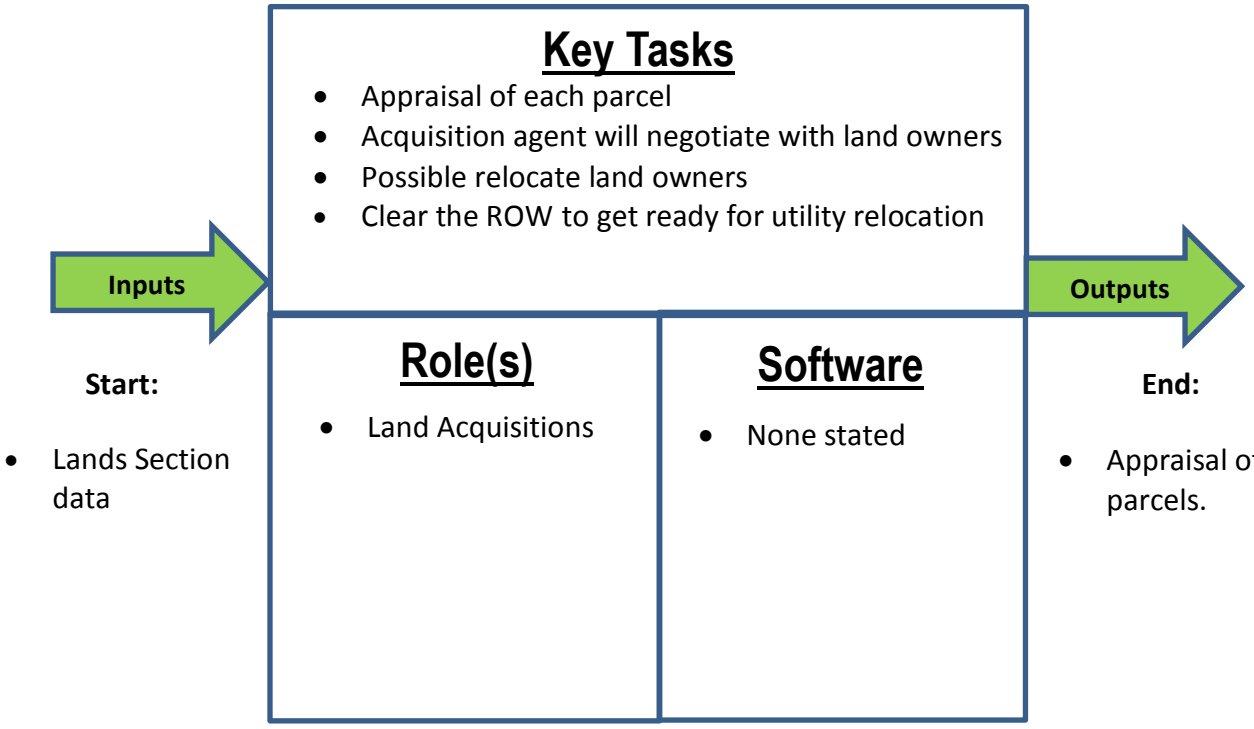


- **People**
  - Limited 3D experience
- **Identified areas of improvement**
  - Obtaining information (core and soil information) – distributed inconsistently.

- Finding as-builds quickly.
- Notified on changes.
- In a limited timeframe, collecting the current design features and alignments/grade and superimposing soils information to assess the current design.

- **Expected / Stated Benefits of Using 3D Models**
  - Review the models for visualization of the new alignment with respect to the existing surveyed alignment. See the cores in 3D.

Group Name: Right of Way Bureau / Acquisition Section
Process Name: Acquisitions



Start:

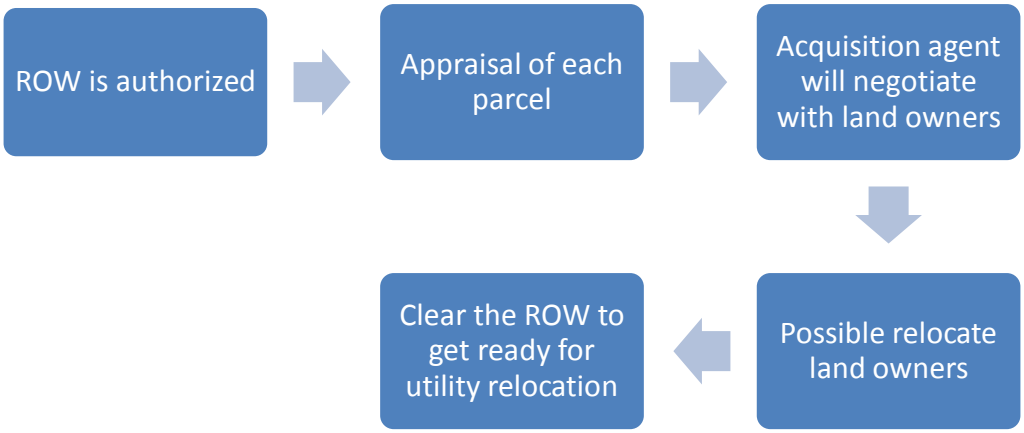
- Lands Section data

End:

- Appraisal of parcels.

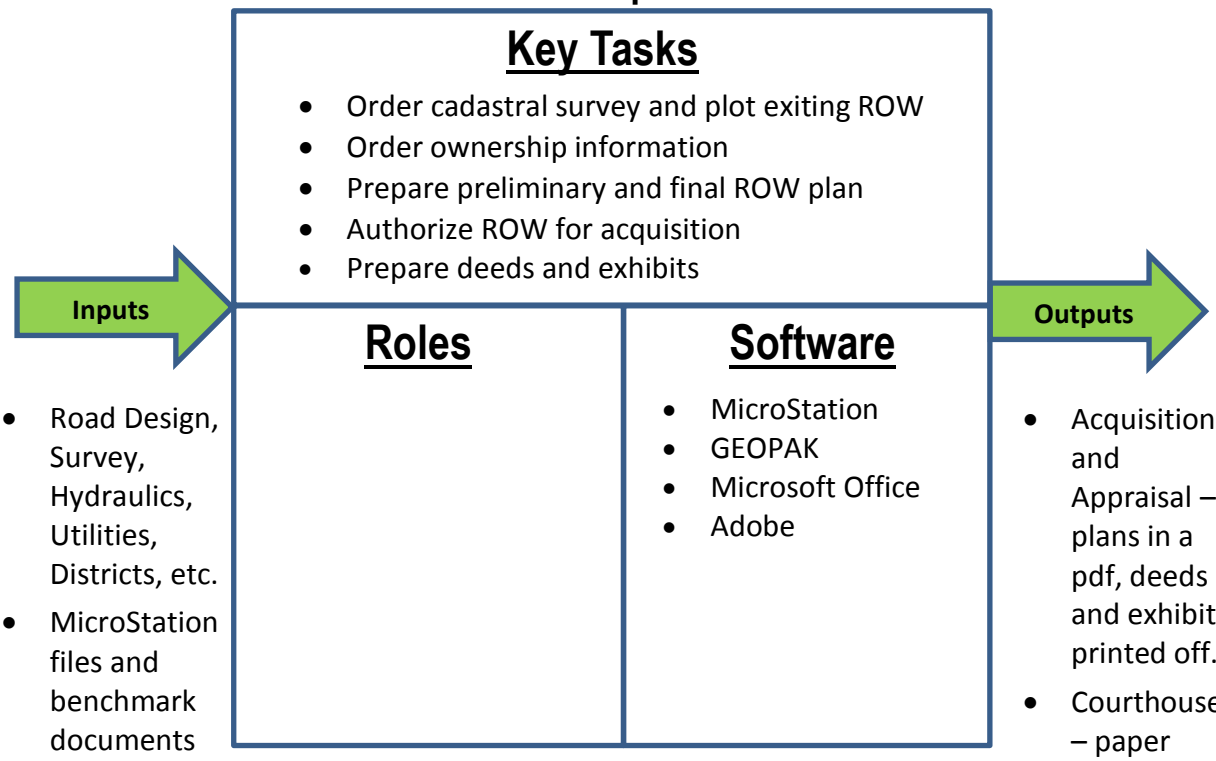
Current State Summary

- **Process**



- **People**
  - Limited 3d knowledge
- **Identified areas of improvement**
  - Having the land owners on the plans connected to a database.
  - Connection to parcel tracking system maybe via tablets or hand held devices or plan sets.
- **Expected / Stated Benefits Using 3D Model**
  - Land owners have challenges communicating plans – rendering (visualization).

Group Name: Right-of-Way - Lands Section
Process Name: Develop ROW Plans



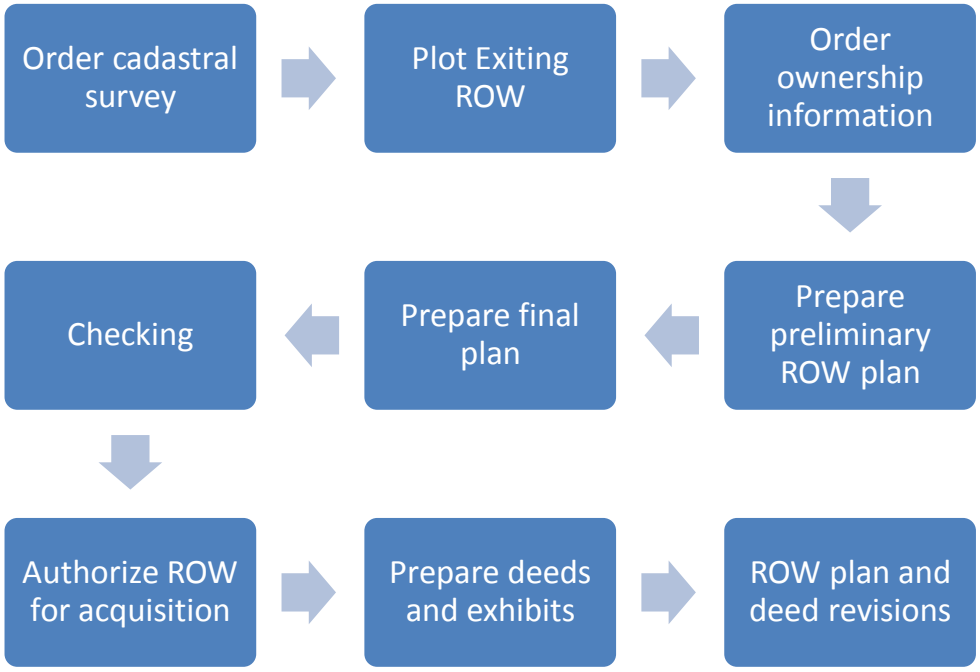
- Road Design, Survey, Hydraulics, Utilities, Districts, etc.
- MicroStation files and benchmark documents and e-mails with attachments.
- Consultant by submittals to consultant design.

- Acquisition and Appraisal – plans in a pdf, deeds and exhibits printed off.
- Courthouses – paper plans.
- Other design entities – CADD files via DMS.
- Public information – e-mail, PDF, Excel.
- Construction and survey – ASCII file coordinates.

Current State Summary

- **Process**

  In-house Design



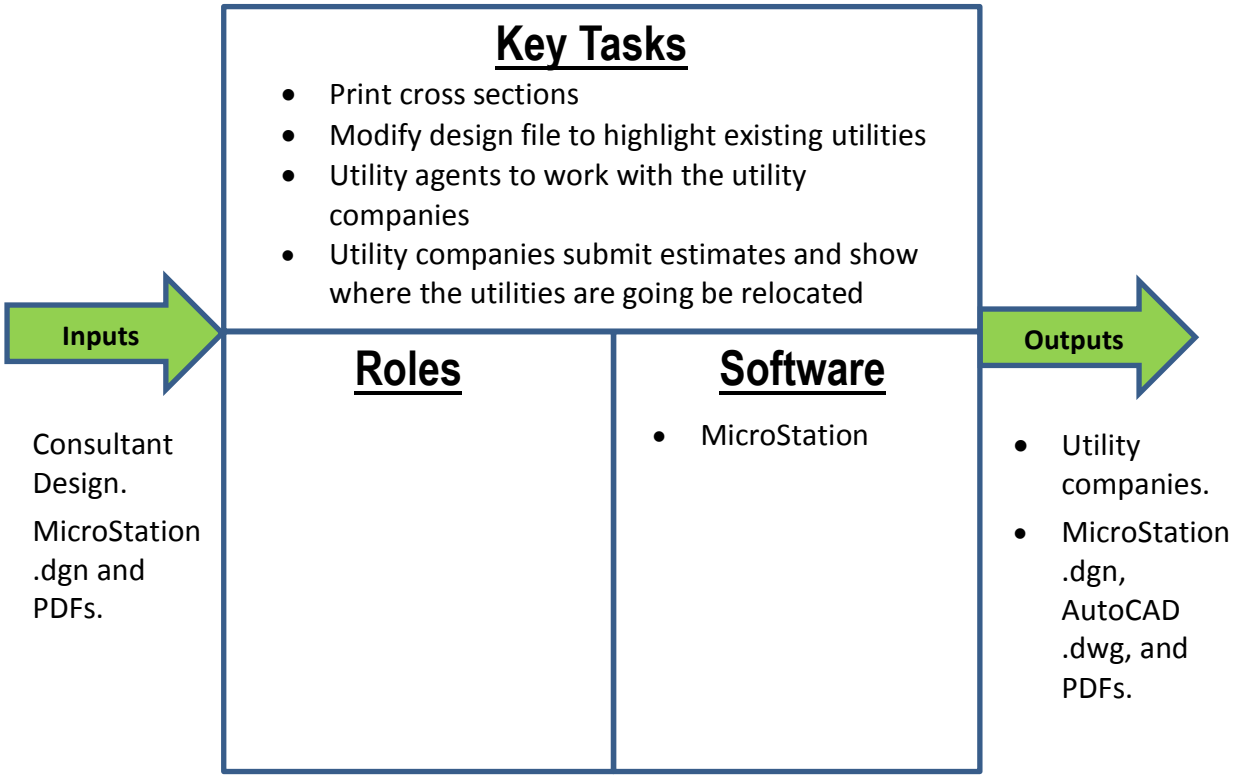
- **Technology**
  - Limited discussions and presentations in R/W Design.
  - Department does some 3D visualizations to provide landowners a visual of the new roadway.
  - The better the survey accuracy (cadastral and topo), the better the end product. The same survey accuracy is used for each project type.
  - Possible 3D modeling benefits identified by the group: looking at proposed impacts to real property in different 3D views to help decide R/W impacts to design acquisition better.
  - R/W exhibit pdf production tool and R/W GIS are being investigated.
- **People**
  - Helena - mostly on the job training.
  - Districts - mostly on the job training.
  - Both – beginner and intermediate. MicroStation class.
- **Identified areas of improvement**

- Communication of changes from Road Design with ROW when is design done with the project.
- Consultant Design needs to notify when the files are put on DMS (notification doesn't happen when files are put on DMS or they are not put on DMS).
- CADD version and standards issues occur between SS2 and SS4.
- Projects schedule and priority is a challenge
- The PMS is not used appropriately.
- Knowing which feature are alternates.
- CADD Standards are a challenge (different symbols for different disciplines).
- Changing road design strip map reference after final limits delivered.
- Having visualization would help.
- This is manual entry of cadastral survey information.
- Manually create CADD design files.
- Most survey cadastral information is manually entered.
- Ownership information from deeds and COS is manually entered.
- New road design centerline process is creating the need to manually reproduce the centerline in the R/W strip map because the needed tools to compliment the new technique do not exist.
- How to know if the data the most current data. MicroStation level assignments, symbology, and cells are a challenge because the data might not be compatible.

- **Identified areas of 3D Impact**
  - Cadd standards
  - Visualization process

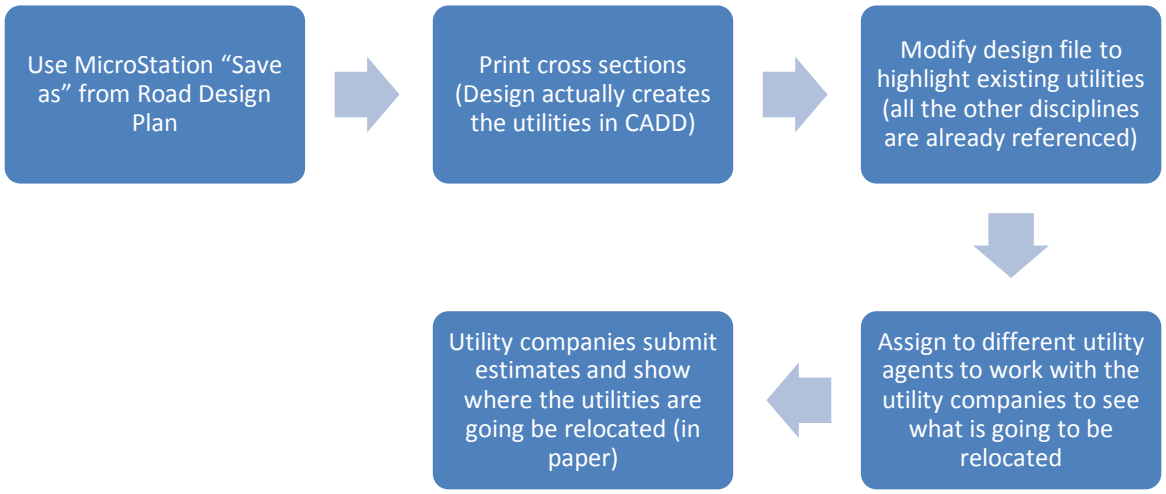
- **Expected / Stated Benefits Using 3D Models**
  - Possible 3D modeling benefits identified by the group: looking at proposed impacts to real property in different 3D views to help decide R/W impacts to design acquisition better.

Group Name: Right-of-Way - Utility Section
Process Name: Utility Relocation



Current State Summary

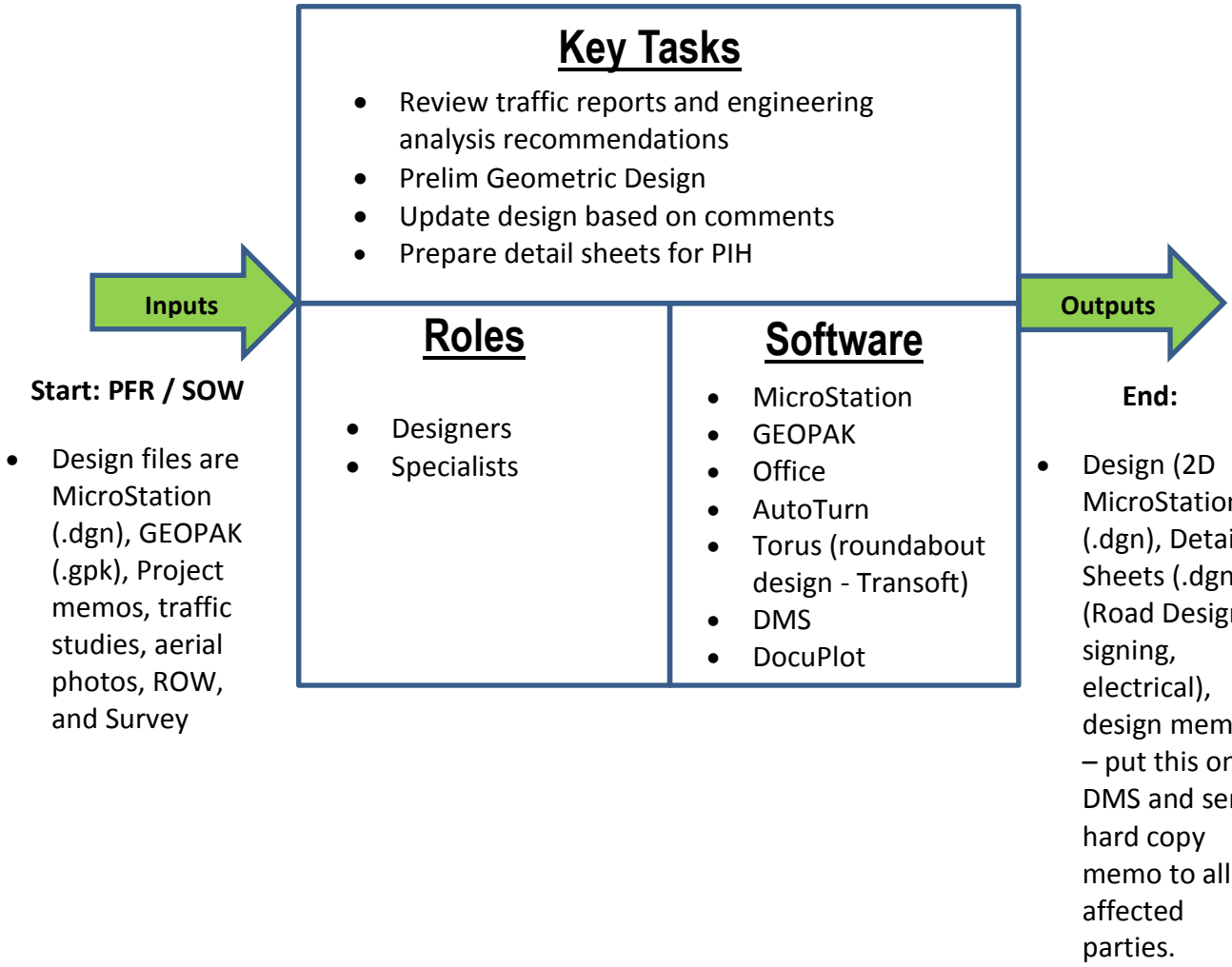
- **Process**



- **People**
  - The Utility Section has representation on the CADD Users Group.
  - Possible 3D modeling benefits identified by the section: help in determining utility conflicts; visualization; convey plan to utility companies.

- **Identified areas of improvement**
  - Poor quality surveys (old survey data).
  - Quality level of survey – utility quality.
  - GIS for existing utilities – access to legacy.
  - No data repository for utility data.
  - Creating 3D utilities.
  - No electronic forms for permits.
  - Compatibility with MicroStation and AutoCAD.

Group Name: Geometrics Section
Process Name: Traffic Geometrics



Start: PFR / SOW

- Design files are MicroStation (.dgn), GEOPAK (.gpk), Project memos, traffic studies, aerial photos, ROW, and Survey

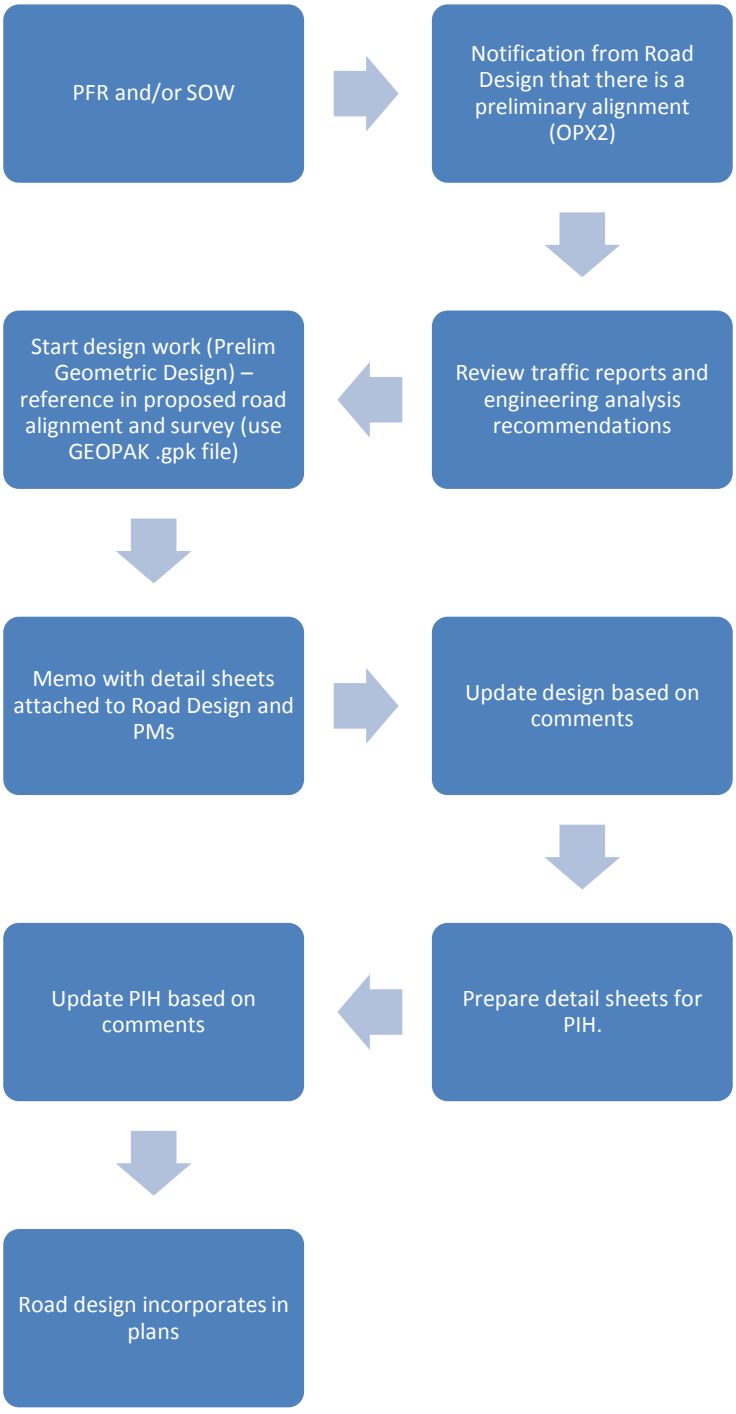
End:

- Design (2D MicroStation (.dgn), Details Sheets (.dgn) (Road Design, signing, electrical), design memos – put this on DMS and send hard copy memo to all affected parties.

Current State Summary

- **Process**

  Projects (centralized)



- **Technology**

- All design is 2D.
- Create details in CADD and Road Design incorporates them into the plans (Road Design traces over plans (strip map) or copies them to incorporate them into their plans).
- Strip maps and map files are the same and are a proposed corridor map.

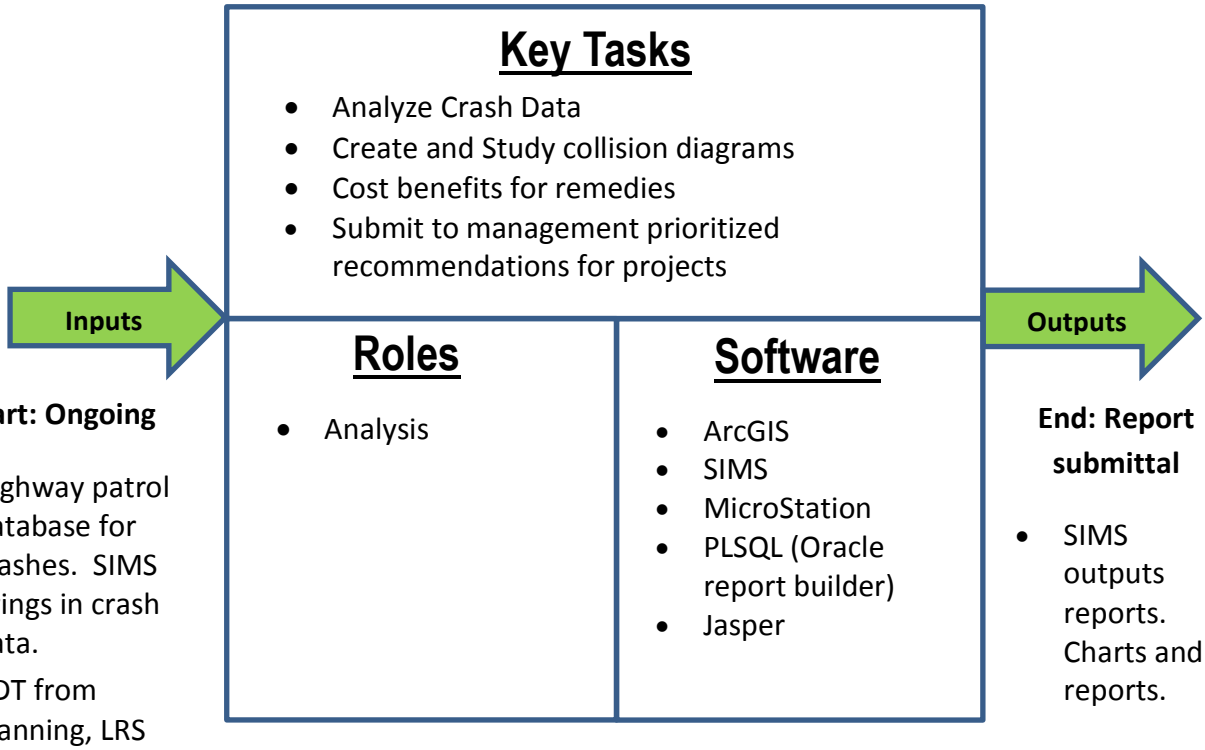
- **People**
  - Limited 3d experience.

- **Identified areas of improvement**
  - Design roundabouts without an alignment from road design. When roadway places the design roundabout in the location of where their alignments are designed it doesn't always match up and we have to rework the original roundabout design.
  - Design changes are not always communicated.

- **Identified areas of 3D Impact**
  - Use of 3D models for geometrics design

- **Expected / Stated Benefits using 3D Models**
  - Better coordination with Design
  - Possible 3D modeling benefits identified by the section: sight-distance, visualization, clearances, and roundabout design.

Group Name: Traffic Bureau - Safety Section
Process Name: Safety Analysis



Start: Ongoing

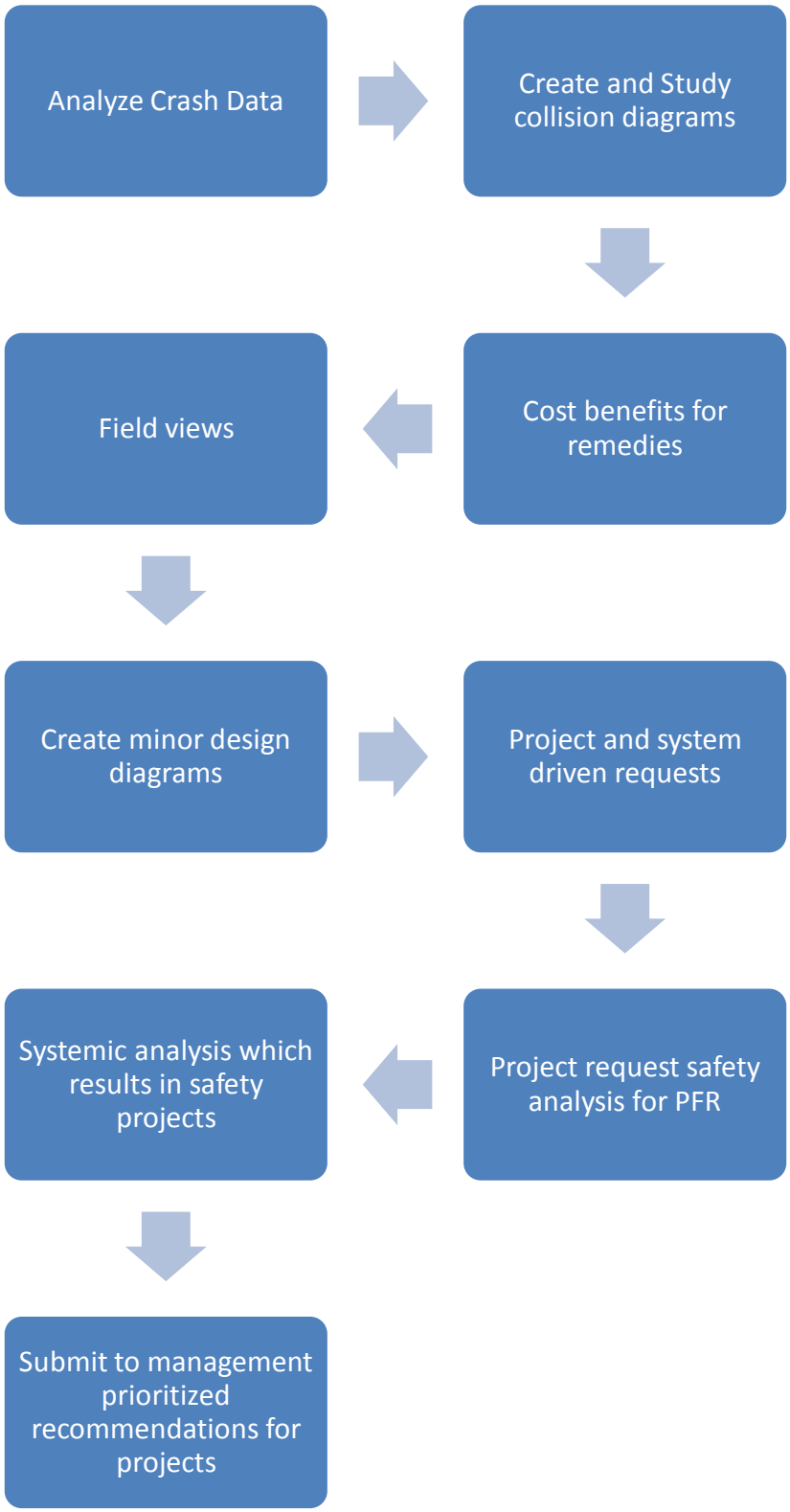
- Highway patrol database for crashes. SIMS brings in crash data.
- ADT from planning, LRS from planning, and other datasets.

End: Report submittal

- SIMS outputs reports. Charts and reports.

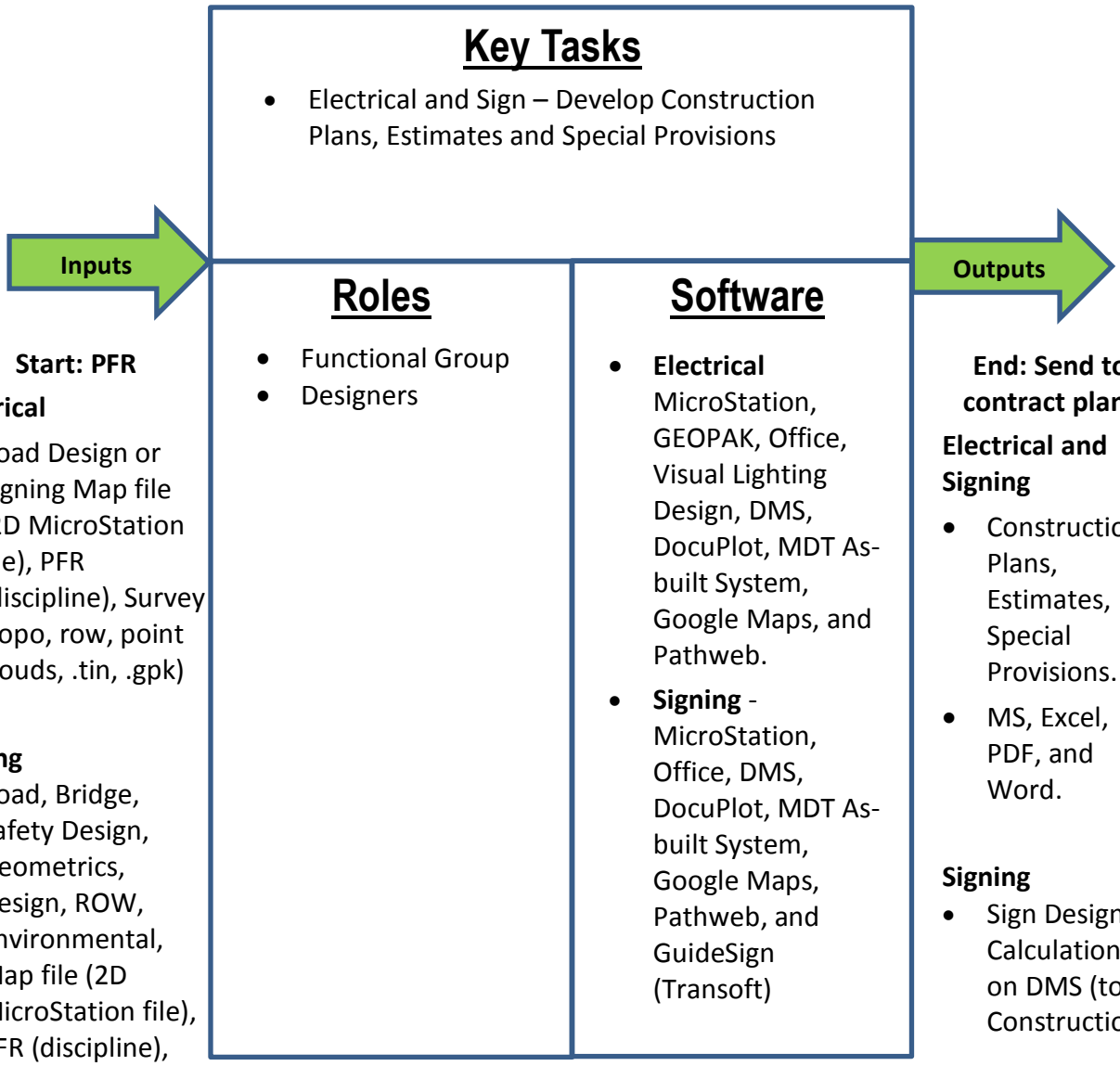
Current State Summary

- **Process**



- **Technology**
  - Highway patrol database for crashes. SIMS brings in crash data.
  - ADT from planning, LRS from planning, and other datasets.
- **People**
  - Not much CAD and GIS experience in the Section.
- **Identified areas of improvement**
  - As-built plans are hard to find.

Group Name: Traffic and Safety Bureau - Traffic Section
Process Name: Safety, Electrical, and Signing Units



Start: PFR

Electrical

- Road Design or Signing Map file (2D MicroStation file), PFR (discipline), Survey (topo, row, point clouds, .tin, .gpk)

Signing

- Road, Bridge, Safety Design, Geometrics, Design, ROW, Environmental, Map file (2D MicroStation file), PFR (discipline), Survey (topo, row, .tin, .gpk)

End: Send to contract plans

Electrical and Signing

- Construction Plans, Estimates, Special Provisions.
- MS, Excel, PDF, and Word.

Signing

- Sign Design Calculations on DMS (to Construction)

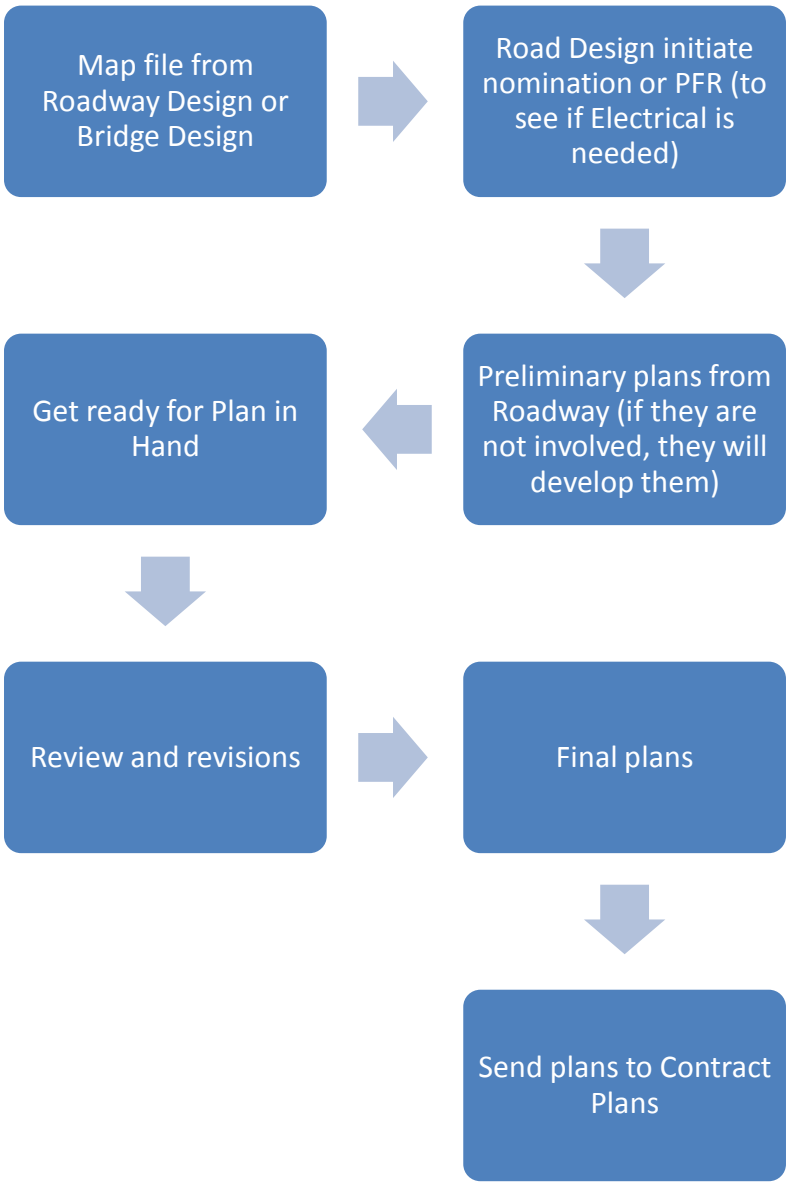
Current State Summary

- **Process**

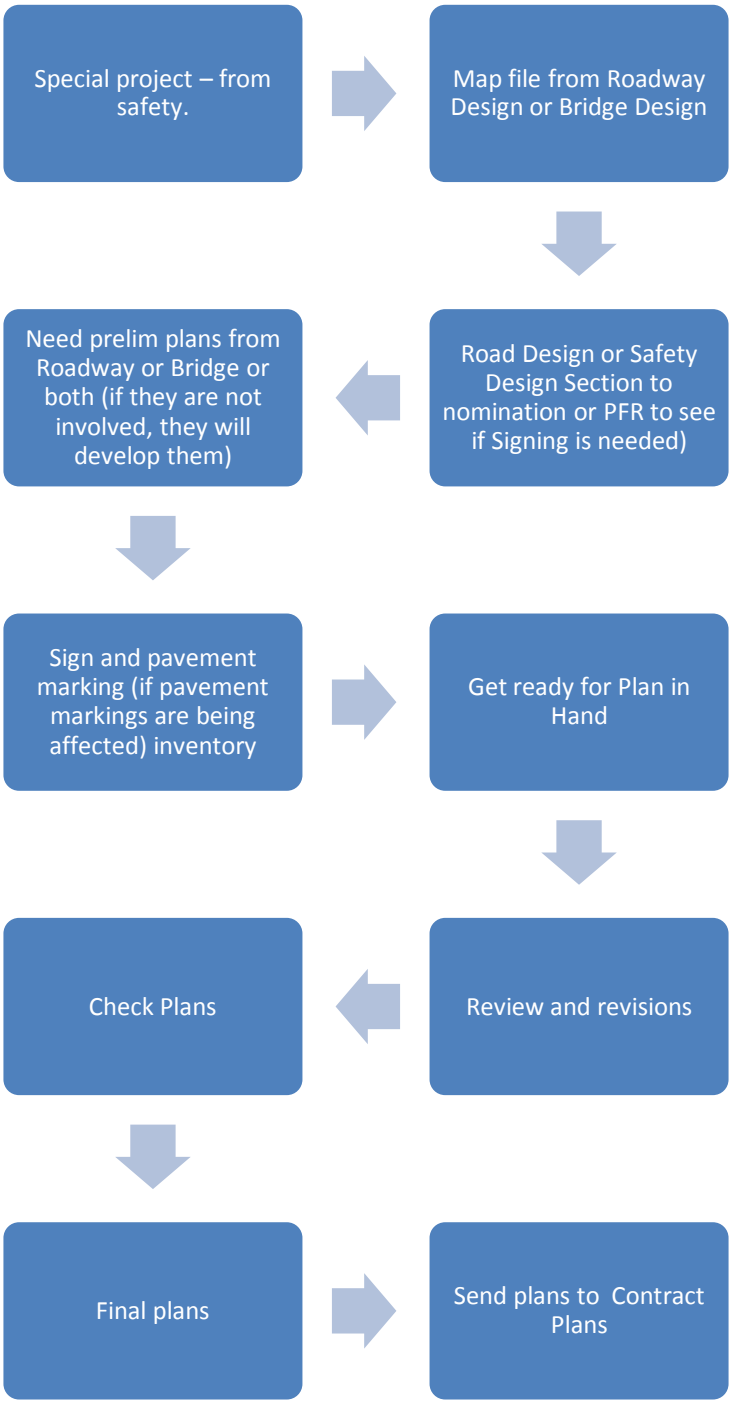
  Safety Design Unit

  - Has the same overall workflow as Road Design.

  Electrical Unit



Traffic Signing Unit



- **Technology**
  - Electrical
    - Road Design or Signing Map file (2D MicroStation file), PFR (discipline), Survey (topo, row, point clouds, .tin, .gpk)

- Signing
  - Map file (2D MicroStation file), PFR (discipline), Survey (topo, row, .tin, .gpk)

- **People**
  - Training is received for MicroStation and Office.
  - Limited 3d model awareness.

- **Identified areas of improvement**
  - Notification that the input is ready. The auto-notification is not turned on in OPX because it generates many emails (Electrical Unit).
  - Signing – sometimes they locate signs based on reference posts, location techniques (roadway alignment would be helpful).
  - As-builts are in 4 locations (DMS, MDT As-built System, hard copies, local share drives).

- **Identified areas of 3D Impact**
  - Placement of signs using 3D models.

- **Expected / Benefits for using 3D Models**
  - Better visualization. All design elements (pavement markings, signs) are in the 3D model.
  - For complicated intersections, showing overhead utilities, signal pole and mast arms