1. Statement of problem
   * Technologies have changed project delivery from analog to computerized systems
   * Digital data becomes available in almost phases
   * Data is not reused
   * Potential reason: professional unaware of availability of useful data from existing sources (Khattak et al. 2015)
   * Importance to enhance data sharing
   * Several research efforts have been made but there is a lack of extensive research that provide guidance on how and what data in which phases to be transferred to whom throughout the entire lifecycle of transportation assets.
   * A research is needed to understand current practices and provide guide for DOTs professionals to understand digital data workflow through project programming to operation phase.
   * Evidence from the vertical sector show that the sharing digital data and information throughout the project life cycle is possible.
   * Once the awareness is enhanced, digital data can be effectively reused, eliminate duplication of data creation, enhance data collection, better and accurate use of data.
   * Background, digital data needs, data management,
   * MTC theme is data driven project delivery
   * Research needs on guidance on data flow
   * Evidence:
     + Obstacles to data use (Khattak et al. 2015): a critical data issues is data awareness which what and the values of existing database.
2. Research goal
   * Guidance on data flow for entire lifecycle of civil infrastructure projects
   * Research contribution what data to be exchange, to whom, importance level of each data item, data format, software, data attribute synonyms
   * Enhance the awareness of data connecting network during the life cycle of transporation asset,
3. Related research and prior work from the research team
   * Idm in vertical building
   * Data management
4. Research objectives
5. Preliminary studies
   * Social network for evaluation importance level of a data attribute
   * Data lifecycle interlinking framework and
   * Data attributes mapping from multiple resources
6. Proposed methodology
   * Phase 1: literature review, benchmarking with the vertical sector
   * Phase 2: workgroup: industry expert, academia researchers, workgroup formation, software vendor
     + Experts are required to have enough experience
     + To capture knowledge, data information requirements and workflow.
     + Who is requesting information? (e.g., Actor architect request of the current design) Why is the business transaction occur? (this is case, cost activity is needed) when at what phase is project execution? What define the entities, objects, and properties of the architectural model needed by the estimator to complete the cost activity? What is expectation of what is delivered between the parties and the applications? To Whom is the request being given? (e.g., the cost estimator is asked to estimate the model). Input and outcome data are during the process.
     + Process map, what tools will be used to draw map (Business process modeling notation (BPMN) standard) this is both readable to human and computer.
     + ***Product*** of this phase is: scope, business cases (cost estimation, plain language description of the activity/process, it is advisable for industry terms to be standardized within the IDM, specifically the IFC phases, participant names, disciplines, activity or service name, terms can be found in ifd library) a process map (visualization of the business use case, estimator and designer, input, output, activities), exchange matrix/tables (what to whom and when for each activity in the process map), exchange requirments (what attributes, property, objects), specification/exchange concepts (explanation in plain English) of which and when to exchange information, information understanding standardization, data exchange format, exchange scenarios and purposes, workflow, data sharing, data format and content requirements for an industry activity that implemented digitally by software and computerized technologies, identifying software application involved in each business case.
     + Existing data bases and resources
     + Data map, actor, databases (owners, data attributes, main use of data)
   * Phase 3: data mapping matrix, projection methods, between exchange requirements and data objects in software application.
7. Research plan