RESEARCH METHODOLOGY
- RESEARCH DESIGN-

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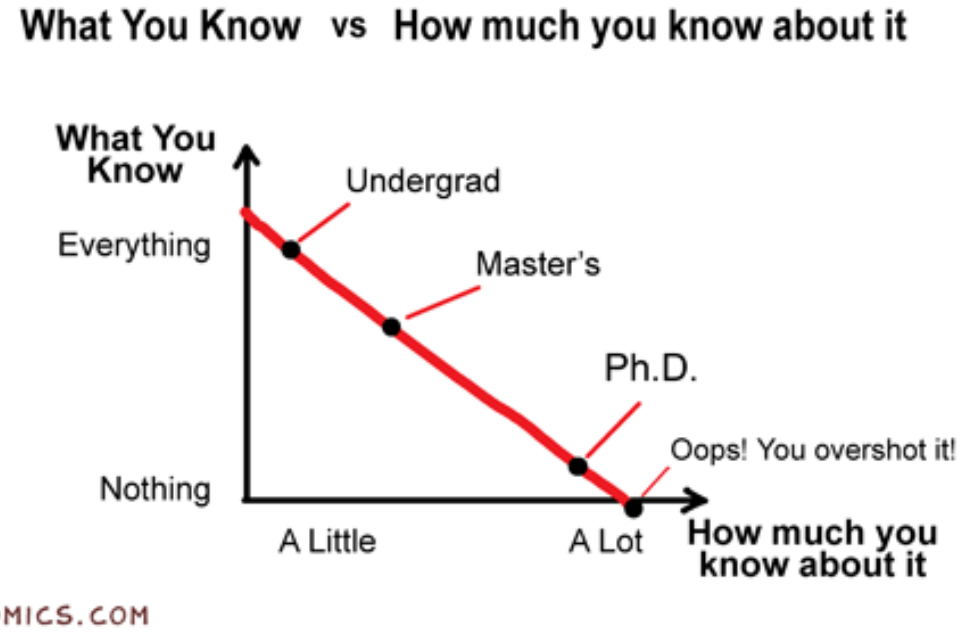
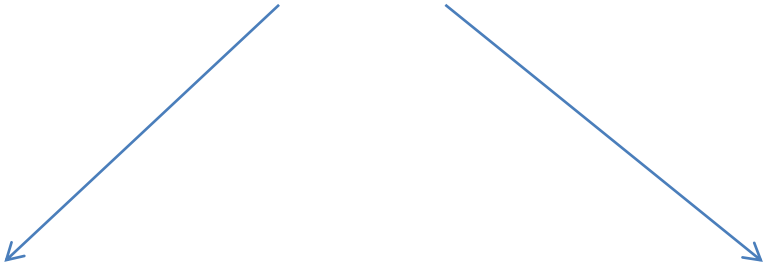
D02 124

Research>>Master, PhD



FINISH is better than perfect!

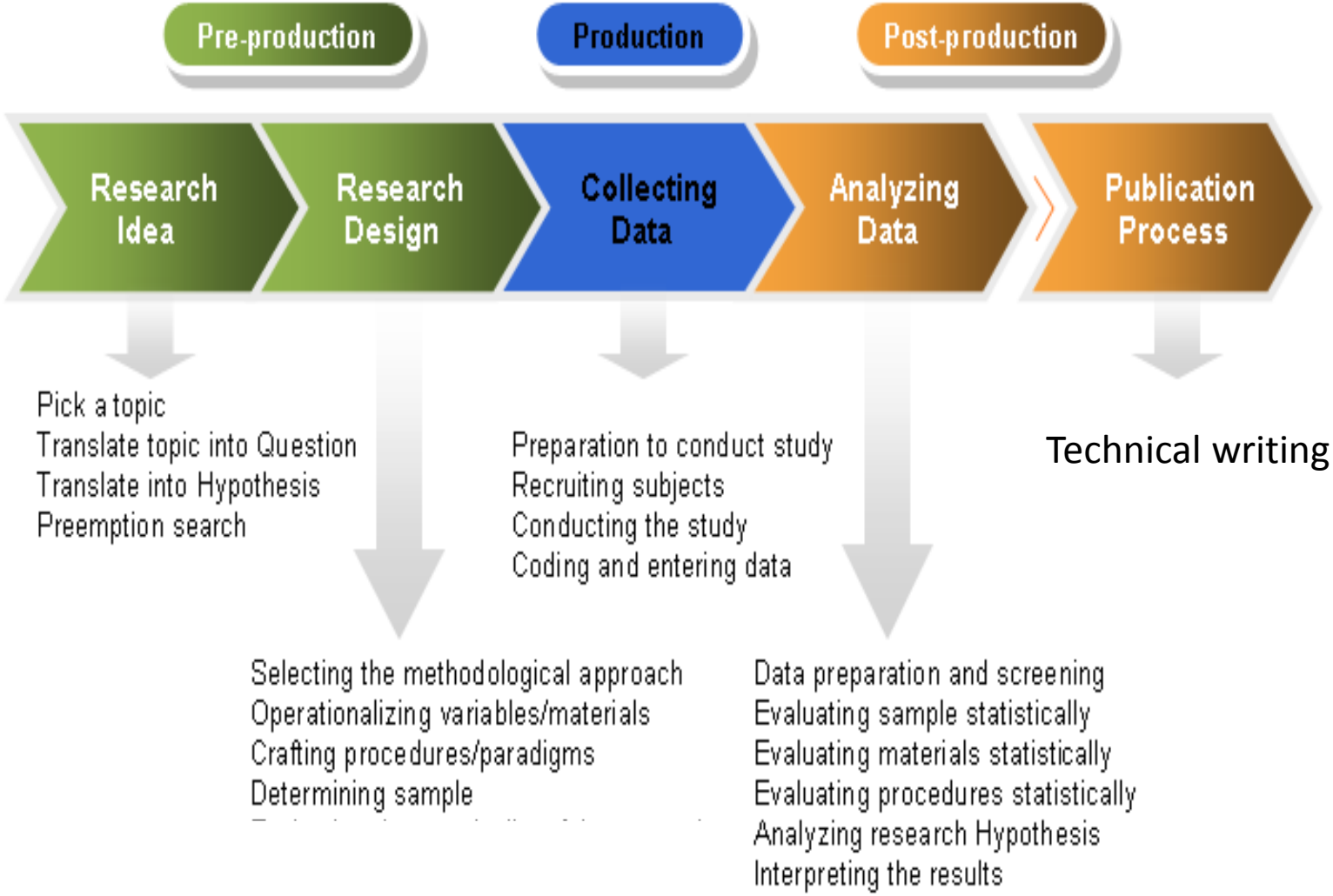
Research



Grant-based

No grant

Basic steps in conducting research



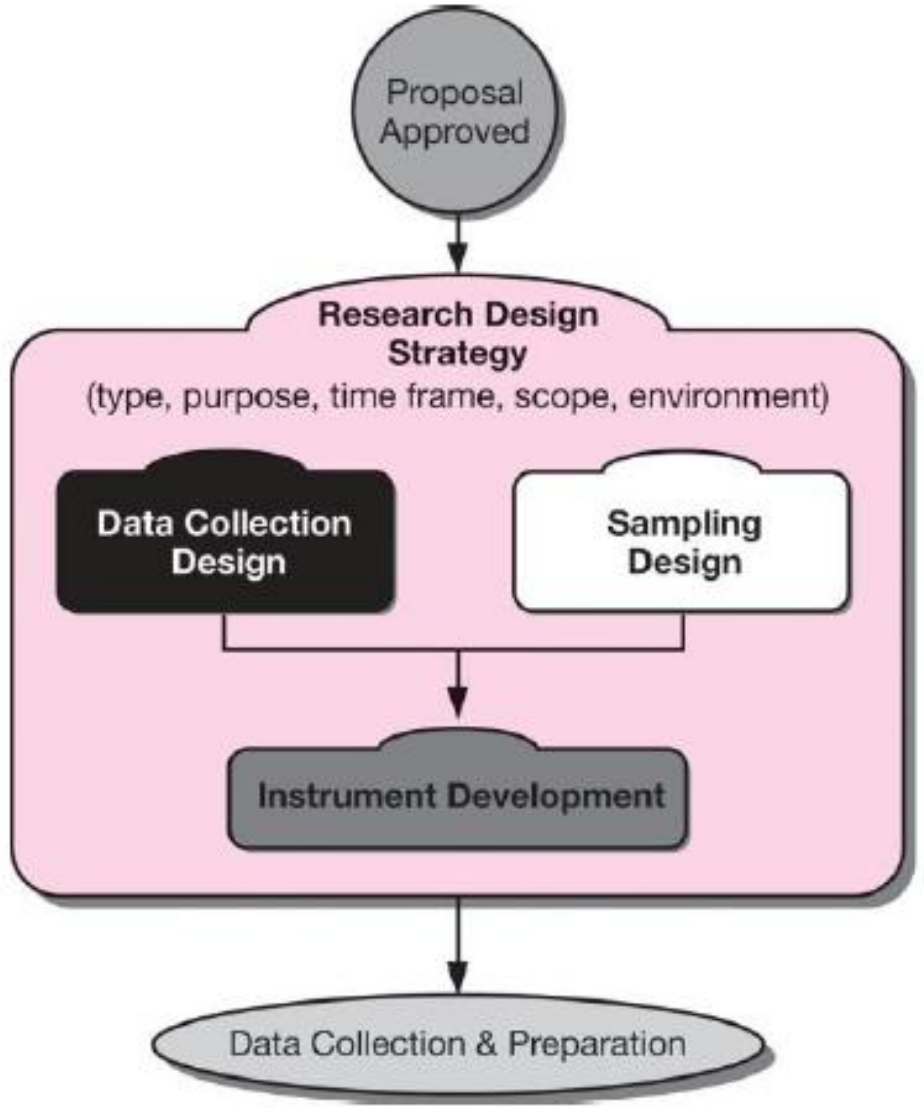
Basic steps in conducting research

- SELECTION FIELD OF INTEREST
- IDENTIFY AND FORMULATING THE PROBLEM
- REVIEW (READ A LOT, COMPARISON)
- AIM AND OBJECTIVES

BEFORE

- RESEARCH DESIGN: METHODOLOGY, WHAT TO DO? HOW TO START? PLANNING AND EXECUTION, TESTING, EXPERIMENTAL WORK, SAMPLES
- DATA COLLECTION AND ANALYSIS
- TECHNICAL WRITING (RESULTS DISCUSSION, INTERPRETATION – to answer WHY?)

AFTER


Proposal Approved
Research Design Strategy
(type, purpose, time frame, scope, environment)
Data Collection Design
Sampling Design
Instrument Development
Data Collection & Preparation

Research Design

- MEANING- A **research design** is a systematic plan to study a problem

- A major issue regarding what, where, when, who, which, HOW, WHY

- Research design summarizes the procedures for conducting a study, including when, and under what conditions the data will be obtained. This is to specify a plan for generating empirical evidence that will be used to answer the research questions.

- The design of a study defines the study type, research question, hypotheses, independent and dependent variables, experimental design, data collection methods and a statistical analysis plan.

Research design always gives the answers of following questions :

- What is the study about ?
- Why is the study being made ?
- Where will the study be carried out ?
- What type of data is required ?
- Where can the required data be found ?
- What periods of time will the study include ?
- How many sample ?
- How will the data be analyzed ?

Need for research design

- Smooth progress of the project
- Yield maximum information with minimal resources
- A better and more reliable result, validity
- Helps in identifying inadequacies and flaws before commencing the study

Good Research Design

- Yields maximum information (avoids collecting unnecessary data)
- Maximizes reliability of results
- Provides firm foundation
- Helps organising one's ideas
- Give chances to foresee flaws & inadequacies
- Incorporates by learning from others critical comments & evaluation
- Researchers examine data critically
- Data valid and verifiable
- Researchers specify limits

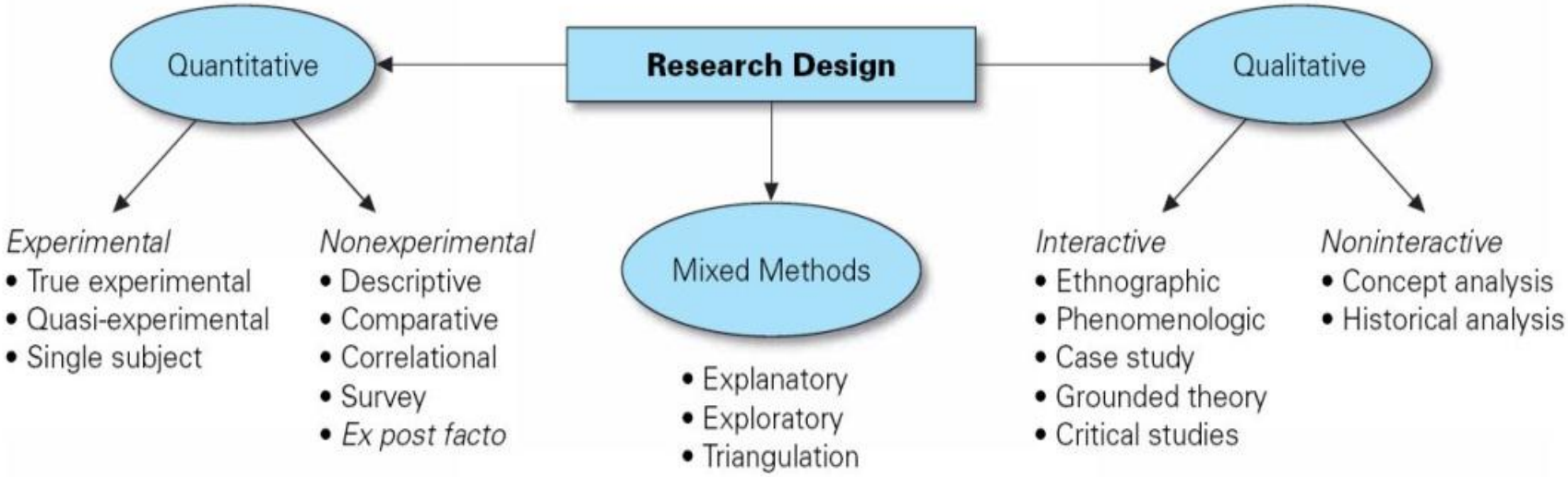
– Experimental design involves:

Trial: Preliminary investigation

Observation: results must be carefully observed and recorded. (include comments)

Systematic: the research is planned and done with PURPOSE.

Type of Research Design



Type of Research Design

- Fixed designs (quantitative) are normally theory driven; otherwise it is impossible to know in advance which variables need to be controlled and measured. Often, these variables are measured quantitatively.

- Flexible designs (qualitative) allow for more freedom during the data collection process. One reason for using a flexible research design can be that the variable of interest is not quantitatively measurable, such as culture. In other cases, theory might not be available before one starts the research.

One can split the overall research design into following parts:

- Method of data collection to be adopted
  - Primary data (collected for first time) or secondary (collected and analysed by someone else)
  - *Observational design*: the conditions under which observations are to be made
  - *Operational design*: the techniques or tools by which the above mentioned procedure is to be carried out
- *Sampling design*: the method of selecting items to be observed, sample characteristics
- *Statistical design*: how many items to be observed and in what manner analysed

Important Concepts

- Research Hypothesis
- Dependent Variables
- Independent Variables
- Extraneous Variable

Research Hypothesis

- A prediction or a hypothesized relationship is to be tested by scientific methods
- Formal statement that presents the expected relationship between IV and DV (Creswell, 1994)
- Ex "Null Hypothesis (Null)", H_0 (no difference)

  "Alternative Hypothesis", H_1 (better, reduce or has different)
- Either reject H_0 for H_1 or accept H_0

Dependent & Independent Variables

- A concept which can take on different quantitative values is called a variable . Ex: "weight, height, income etc., are examples of a variable"
- *independent variable* is the variable that is varied or manipulated by the researcher
- *dependent variable* is the response that is measured
- Ex: "if we say that height depends upon age, then height is the DV and age is the IV. Further, if height also depends upon the individual's sex – then, height is the DV and age and sex are the Ivs"

Extraneous Variable

- IVs that are not related to the purpose of the study, but may affect the DV are termed as Extraneous Variable (EV)
- Ex: "the researcher wants to test the hypothesis that there is a relationship between method of compaction and the air voids distribution within a sample. Here, compaction method is IV and air void distribution is a DV. Mold confinement may as well affect the air void distribution, but since it is not related to the purpose of the study, it will be termed as an EV"
- A study must be always so designed that the effect upon the DV is attributed entirely to the IVs and not to some EV

In brief, a research design must contain:

- A clear statement of the research problem
- Hypotheses, selection of dependent and independent variables
- Procedures, tools and techniques to be used for gathering information
- The population/sample to be studied
- Methods to be used in processing and analyzing data

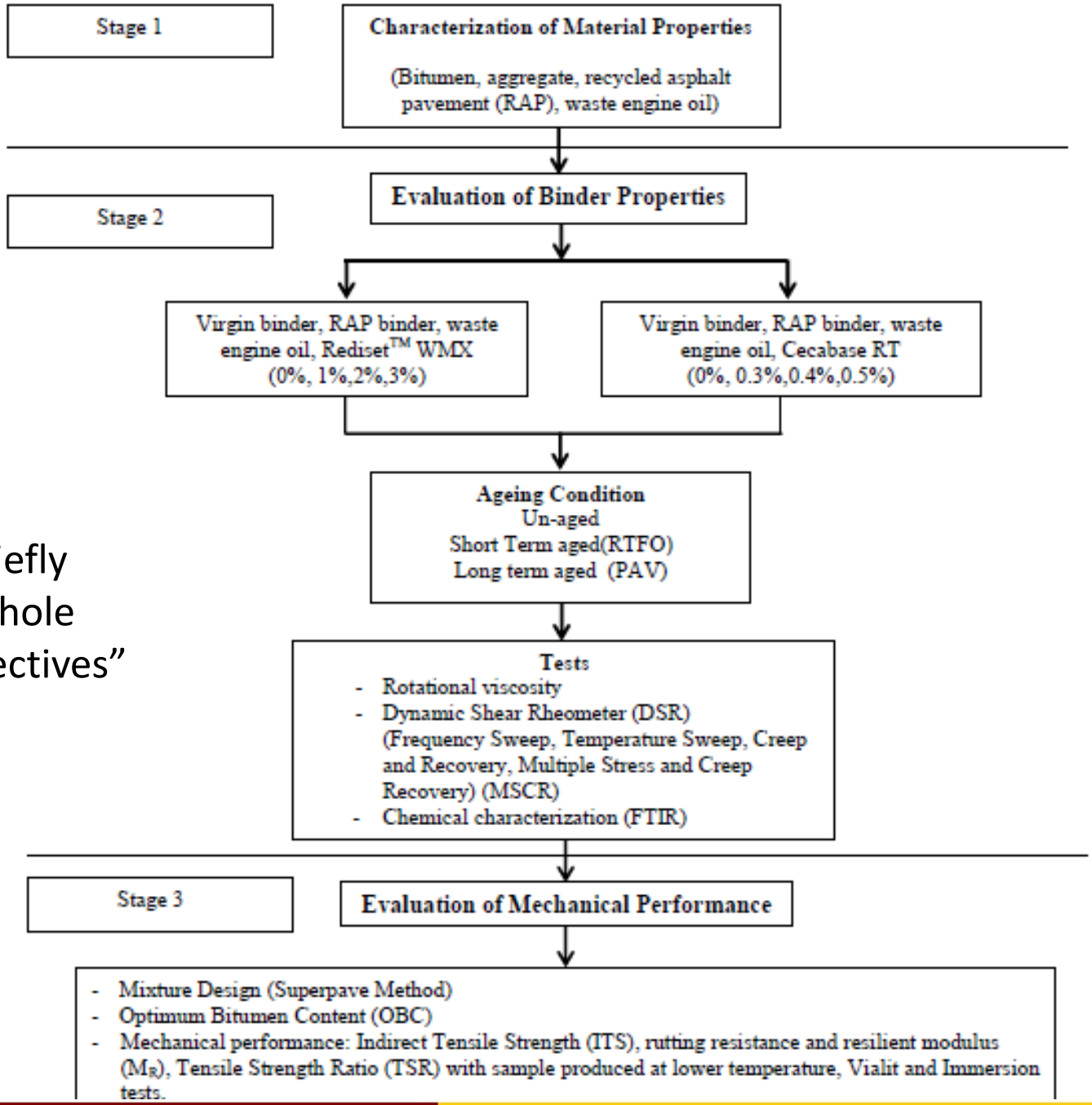
Factors influence research design

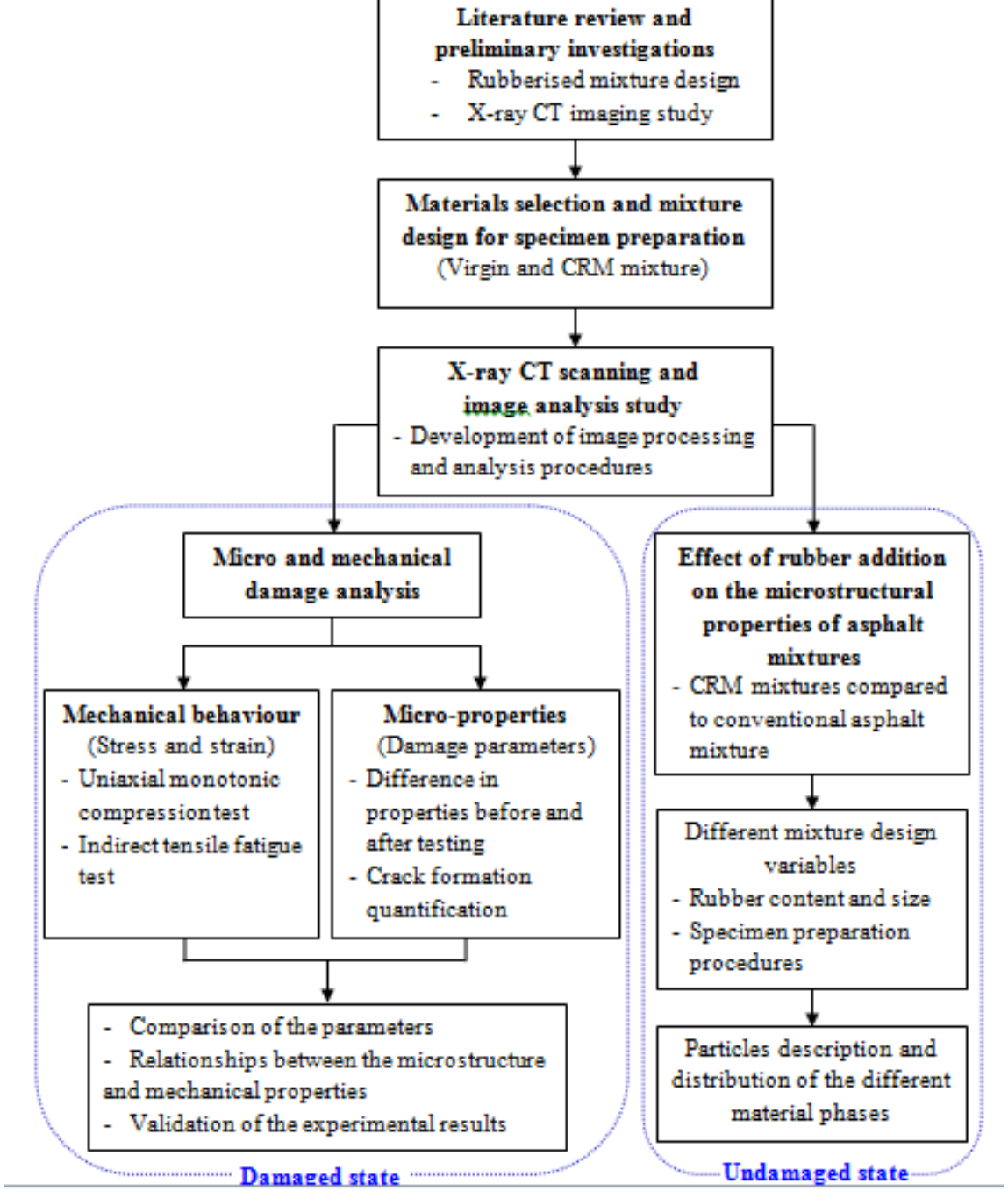
- Time
- Machine, testing, equipment, tools, method for data collection and analysis
- Budget, grant
- Supervision
- Review, journal, textbook, article
- Narrow investigation, novelty
- Flow Chart, Gantt Chart
- Milestones and Dates

"When creating your gantt chart, milestones provide a very easy way to see important dates at a glance. This allows others who view your gantt chart to quickly see the big important dates"

FLOWCHART

"Simple but briefly describe the whole process or objectives"




Literature review and preliminary investigations
- Rubberised mixture design
- X-ray CT imaging study
Materials selection and mixture design for specimen preparation
(Virgin and CRM mixture)
X-ray CT scanning and image analysis study
- Development of image processing and analysis procedures
Micro and mechanical damage analysis
Mechanical behaviour
(Stress and strain)
- Uniaxial monotonic compression test
- Indirect tensile fatigue test
Micro-properties
(Damage parameters)
- Difference in properties before and after testing
- Crack formation quantification
- Comparison of the parameters
- Relationships between the microstructure and mechanical properties
- Validation of the experimental results
Damaged state
Effect of rubber addition on the microstructural properties of asphalt mixtures
- CRM mixtures compared to conventional asphalt mixture
Different mixture design variables
- Rubber content and size
- Specimen preparation procedures
Particles description and distribution of the different material phases
Undamaged state

Gantt Chart of Research Activities

"progress"

Item	Details	2014							2015												2016				
		1st year							2nd year																
		J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M
1.	Preliminary investigation																								
2.	Preparation and characterization evaluation of materials																								
3	Binder evaluation																								
4.	Mix design and sample preparation																								
5.	Performance Testing																								
6.	Data analysis and Report Writing																								

"Literature review??"

Milestones

"target or achievement upon completion"

Description	Date	Cumulative Project Completion Percentage(%)
Preliminary Investigation	31/08/2014	10
Preparation and characterization evaluation of materials	31/12/2014	25
Binder evaluation	31/07/2015	50
Mixture design	31/10/2015	60
Performance Tests	31/03/2016	85
Report writing and submission	31/05/2016	100

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THANK YOU