



Driving Indiana's Economic Growth

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Back To Basics: Estimating for Success

Planning Level Cost Estimation

Purdue Road School
26 March 2008



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Presenters

- Audra Butts, Economist
 - INDOT Planning
- Daniel McCoy, Highway Engineer
 - INDOT Program Engineering
- Jeremy VanVleet, Highway Engineer
 - INDOT Program Engineering



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Agenda

- Introduction
- Accounting for Price Increases
- What INDOT Program Engineering Uses
- INDOT Processes for Calibration
- Software Demonstration
- Questions?



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Introduction

- Calculating a reliable cost estimate with minimal design information is an obstacle while planning a project
- It is important to have accuracy and speed when creating an estimate, as well as consistency with estimates at design and construction levels



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Estimating While Accounting For Commodity Price Increases

- Impact of recent years
- Necessity of developing a method for making necessary adjustments in estimating – including during planning stages



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Inflation & CCI

- Inflation: Measures the rise in general prices over time. Commonly done using a basket of goods
 - Tracer: Measures the change in prices based on historical data
- Construction Cost Index (CCI): Measures the change in the cost of highway construction input prices over time



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Inflation & CCI

- Inflation
 - Uses a basket of goods and measure changes in price
 - Examples: CPI, PPI, GDP Deflator
- CCI
 - Measured using a basket of goods directly related to highway construction.



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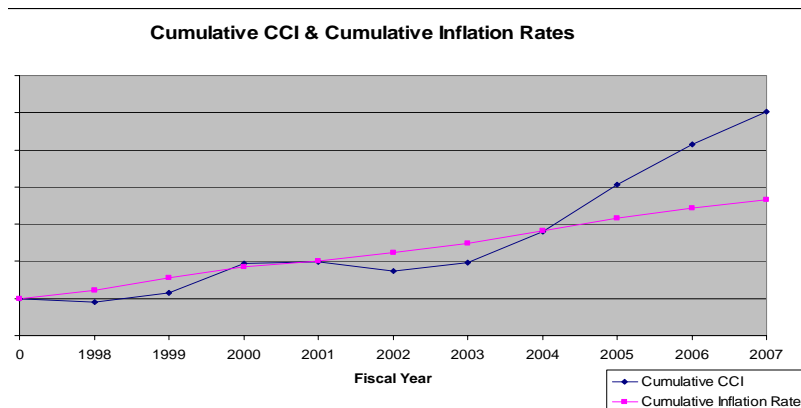
CCI – The basket

- CCI includes the following goods:
 - Hot Mix Asphalt
 - Structural Concrete
 - Crushed Surfacing
 - Structural Steel & Reinforcing Bar
 - Concrete Pavement
 - Crude-oil/Petroleum/Diesel
 - Others



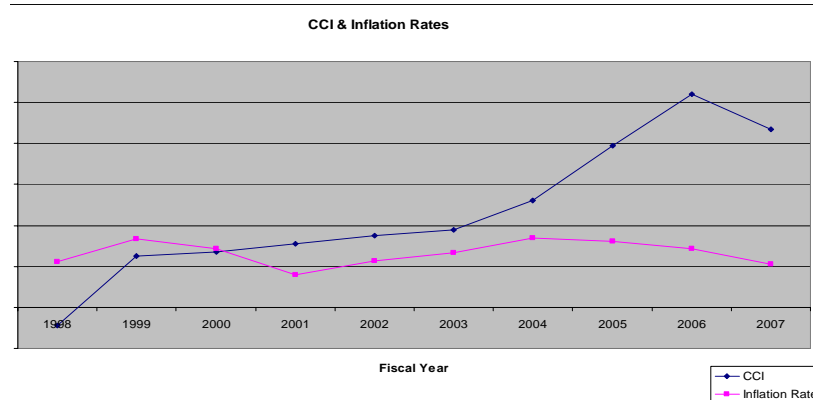
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Cumulative Growth Chart



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Inflation & CCI Chart



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Future Trend of CCI

- Upward trend likely to continue
 - Global demand for major construction inputs
 - Continued increased cost of crude-oil (diesel)
 - Dependence on commodities with sharply rising prices



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Importance

Because of the difference between inflation and CCI, inclusion of a more accurate inflation number is crucial to the accuracy of estimates and ultimately the effectiveness of the planning process.



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What INDOT Program Engineering Uses

- INDOT uses a program called TRACER
- TRACER is a part of AASHTO's Trns*port software packages and was created by EarthTech
- The program is based on RS Means data



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What INDOT Program Engineering Uses

- TRACER allows for:
 - The use of a wide variety of user defined construction categories to build an estimate
 - Multiple iterations when comparing various alternatives
- TRACER cost estimation tool is ideal for the scoping/planning level since minimal design information is available



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INDOT Processes for Calibration

- In order to maintain consistency throughout the Program Engineering Division and to keep the program up to date throughout the year, it is continually calibrated so that estimates reflect the bids of projects recently let
- Various aspects of the program that are calibrated are parametric models, escalation, and markups



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INDOT Processes for Calibration

- Parametric Models
 - The models contain all of the principle variables in a general cost estimate for a typical project
 - During the pre-design phase, it is usually only necessary to utilize the core models
 - Special cases may warrant the use of other models to keep the estimate accurate



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INDOT Processes for Calibration

- Special cases include:
 - separate model for enclosed storm sewer in urban areas
 - separate excavation cut & fill model for extraordinary earthwork
 - separate retaining wall CIP concrete model for notable earth retaining structures



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INDOT Processes for Calibration

- Since pavement accounts for a large portion of the cost in a project, pavement models will need to be adjusted on a case by case basis as not all projects have identical pavement design
 - Example: functional overlay project vs. new road construction
- Pavement design engineers may need to be consulted if the case warrants



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INDOT Processes for Calibration

- Escalation
 - INDOT currently uses the 2007 version of TRACER that has a base date for cost of 1-1-2007
 - The program uses an inflation rate based on historical data which, as was previously mentioned, is not as accurate since construction costs are escalating at a greater rate



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INDOT Processes for Calibration

- Escalation continued
 - As a result of the escalation rate differences it is necessary for the user to overwrite the program defaults and input a reasonable rate



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INDOT Processes for Calibration

- Markups
 - TRACER has default values for various markups that can be overridden by the user
 - The markups include mobilization, pre-construction services, contingency, and SIOH (Supervision, Inspection, Overhead)
 - There are other markups that pertain to the contractor that generally are not necessary as they are not known at the planning & program engineering phases



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TRACER Demonstration

- Added Travel Lanes
- 5 Miles in Length
- High Volume Road
- Existing Roadway 2 Lanes



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Questions?



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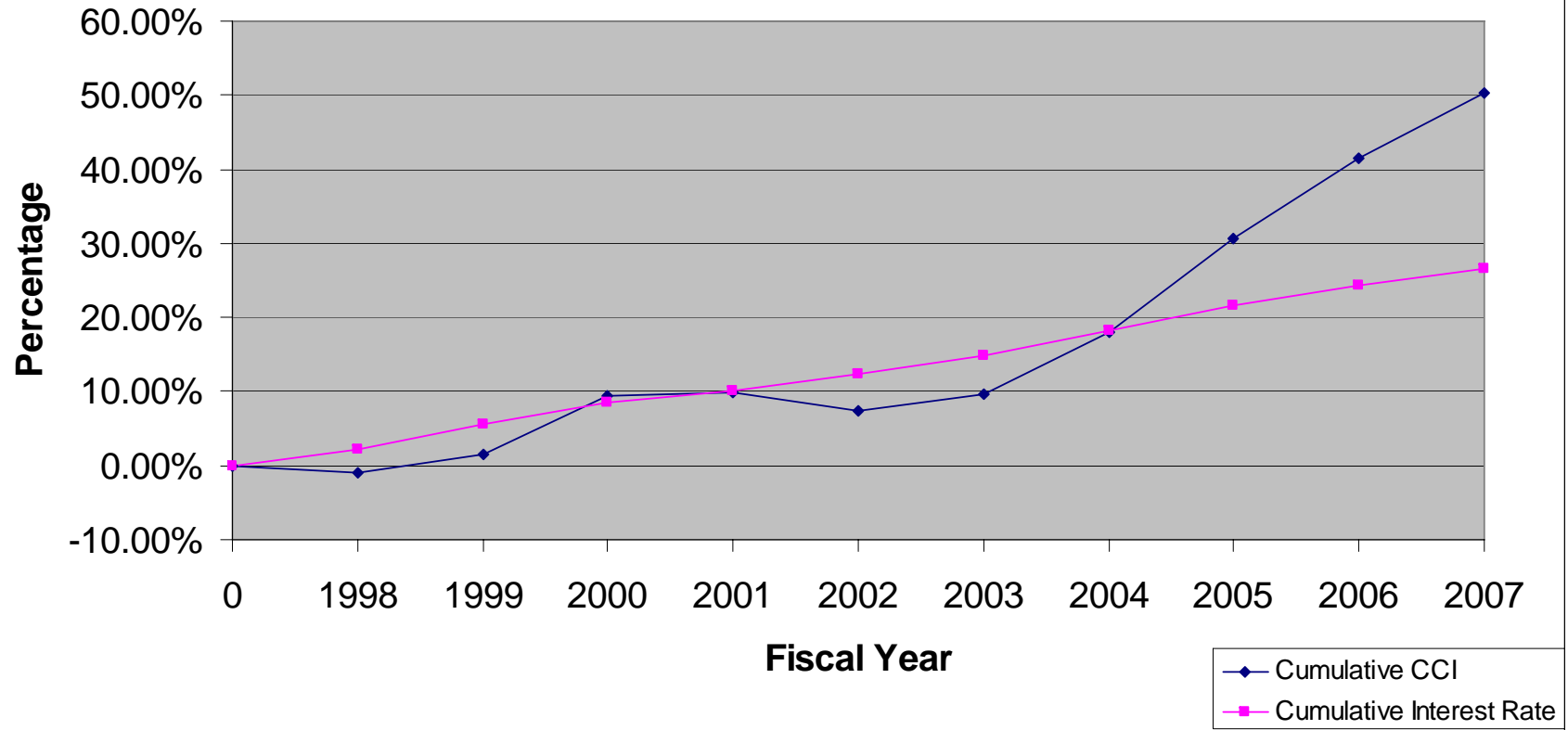
2008 Road School Notes (Jeremy L. VanVleet)

- Slides 14 - 15: What INDOT Program Engineering Uses:
 - INDOT's program engineering division is currently in the process of making TRACER the estimation software for the division.
 - TRACER is part of AASHTO's TRNS*PORT software package and was created by EarthTech and obtains its cost data from RSMEANS data
 - TRACER is ideal for the planning level since minimal design information is needed to obtain a cost estimate. Although, TRACER also allows for the use of a wide variety of user defined construction categories to build a construction cost estimate at the planning level. Right-of-way and PE costs are not included in TRACER so they need to be added to the estimate outside of program
 - Another advantage of TRACER is the ability to quickly run estimates on multiple alternatives to assist in the determination of a preferred alternative for a project

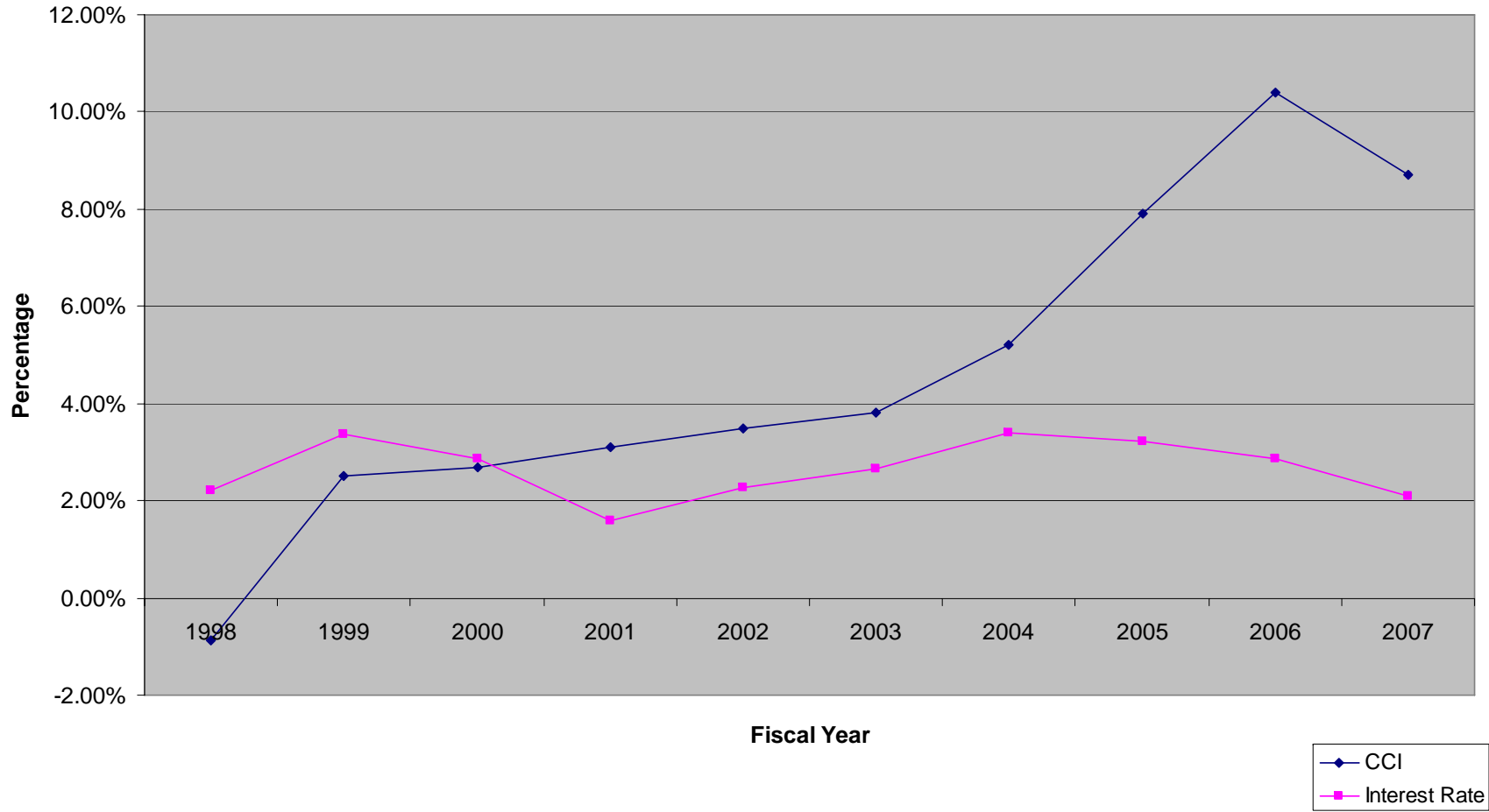
- Slides 16 - 22 : INDOT Processes for Calibration
 - INDOT's Program Engineering Division is in the process of calibrating TRACER to obtain a set of user guidelines to maintain consistency throughout the division and so that the estimates reflect the bids of projects recently let
 - The main items being calibrated are the parametric models, escalation, and markups
 - The parametric models contain all of the principle variables in a general cost estimate for a typical project. It is usually only necessary to utilize the core models
 - Although, as we all know projects are not always the same and there are projects with special circumstances. This is where the use of other models is needed to keep the planning level estimate in line with the design and construction estimates.
 - The possible special circumstances include but are not limited too the use of separate storm sewer models, excavation models, and retaining wall models.
 - An example for the use of the storm sewer model would be for something like a storm sewer replacement due to pavement widening through an urban area where the storm sewer is going to be a major cost item when it comes time for design and construction
 - Currently INDOT planning is in the process of getting a value to input into TRACER for this model due to the information that is needed to run this model which is typically not known at the planning stage

- The excavation and retaining walls can be used if extraordinary earthwork or a retaining wall needs are known at this stage and need to be accounted for in the estimate
- There is another set of models that need to have special attention paid to them when completing a TRACER cost estimate and those models are the roadway models. In the roadway models the Pavement items account for a large percentage of the cost. The roadway models need to be adjusted according to the type and extent of the project
- Looking at the example on the handouts you can see that there are different levels of pavement work and the amount of pavement can vary by a large amount. Therefore a pavement design engineer may need to be consulted to determine what a typical pavement design would be for your project according to the daily traffic and the percent of trucks that use the roadway
- That is the last of the calibration that has been performed on the models to date. The next item that has been calibrated for the planning division is the escalation rate used in TRACER
- INDOT currently uses the 2007 version of TRACER that uses a base date for cost of January 1st, 2007
- TRACER uses an inflation rate based on historical data and the program only escalates the estimate at a rate of 2% per year, which is not very accurate as was previously discussed due to the fact that construction costs are escalating at a greater rate than the inflation rate
- As a result of these differences it is necessary for the user to overwrite the program defaults and input a reasonable escalation rate
- The last calibrated items in TRACER are the markups. TRACER has default values that can be overridden by the user. Some of the markups include mobilization, pre-construction services, and contingency
- There are other markups included that pertain to the contractor that are not usually known at the planning phase and do not need to be included in your estimate
- TRACER can be a powerful tool at the planning level in determining the allocation of money for a certain project. Within the INDOT planning division the calibration will continue on into the future to keep up with the fluctuating construction costs to maintain accuracy in the planning level cost estimation. With the use of TRACER planning level estimates should be in the same ballpark as the design and construction estimates
- Now that you have some idea of what TRACER is about and how it is used at INDOT, Daniel McCoy will now walk us through a demonstration of TRACER

Cumulative CCI & Cumulative Interest Rates



CCI & Interest Rates



- Project Parameters
 - Added Travel Lanes Project
 - 5 Miles in Length
 - High Volume Road
 - Existing Roadway is 2 Lanes, Proposed to be 5 Lanes
- Program Information
 - Road School Demo, Modify
 - Program Variables
 - Location
 - Location Cost Factor
 - Program Date and relation to escalation
- Markups
 - Manually Set Escalation(Estimated CCI) Value
 - Construction Date Set to (1-2007)
 - Construction Duration Set to (0)
 - This Allows for Ease of Manually Setting Escalation
 - 18% for January 2009 Letting Date
 - Sales Tax is Set to 5% Based on Year 2007
 - Mobilization (5%)
 - Pre-Construction Services (5%)
 - Contingency (5% – 10%) – Will Makeup for Lack of Info on Prime & Sub Values
 - SIOH – Supervision Inspection Overhead (6.5%)
 - Yellow Denotes Subtotals
- Organizational Breakdown
 - Project Name
 - Roadway or Project Aspect Name
 - Parametric Models – Only three models available for this demo version
- Roadway Mainline
 - Roadwork
 - Roadway – Construct
 - Length (26,400 ft – 5 miles)
 - ROW (170 ft)
 - Type (Divided – TWLTL)
 - Lanes (5)
 - Surface (Asphalt)
 - Pavement Hotmix 16”, Base 12”, Subgrade 6”, All Unstabilized
 - Sidewalk Full Length Both Sides of Roadway
 - Curb and Gutter Closed Drainage

- Removal
 - Roadway – Demolish
 - Length (26,400 ft)
 - Width (40 ft)
 - Surface (Asphalt)

- Bridge
 - Bridge Work
 - Bridge – Demolish
 - Length (150 ft)
 - Width (43 ft)
 - Separation (Roadway over Railroad – 23.5 ft)
 - Bridge Definition (Deck Beam)
 - Further Definition Available

- Signals
 - Signal Work
 - Signs & Signals
 - Span Wire (7 Intersections, Vehicle Detection, LED Signals)
 - Mast Arm (3 Intersections, Vehicle Detection, LED Signals)
 - 20 Intersection Warning Signs
 - 10 Speed Limit Signs

- Comments
 - It is important to note the Construction Date for the Project since the date was set to (1-2007) in the escalation section of Markups
 - Round up to the nearest \$1,000 so as to not give false confidence in preciseness of estimate – no estimate can reasonably be expected to be accurate down to the dollar