

# State of Tennessee

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State of Tennessee  
Working Document  
regarding  
Multi-year Strategy for Improving Performance of  
Projects and Project Teams

*presented by*

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## Role of the State Architect

Provide operational and technical staff support to the State Building Commission (SBC) which approves funding for all projects associated with improvements to real property

Responsible for recommending, then developing and implementing SBC approved initiatives, programs and policies

- facilitated through the three **State Procurement Agencies (SPAs)** – DGS's STREAM, TBR and UT
- assisting SPAs so their projects are expeditiously approved and delivered efficiently and responsibly



The State's portfolio needs include:

Designed, built or renovated projects which

- Cost very little or no more initially to construct or renovate than the industry's average

And

- Are highly energy efficient to operate - utilizing 30-50+% less energy on average than minimum code requirements
- Are able to be well maintained at maintenance costs at rates equal to current private industry standards

## State of the State of Tennessee / Design and Construction Industry Conditions

### FY 11/12 FRF Spend Analysis

### Above Industry Standards

Utilities costs

30+%

Repairs and Maintenance costs

63+%

Energy Star Buildings typically operate 40% less than industry standards  
TN Tower was determined to be in the lowest 17<sup>th</sup> percentile

Additionally,

The State's portfolio needs to be:

Developed in a more efficient and effective, timely and cost effective manner (less waste)

30% of projects do not make schedule or budget (and the primary problem is poor coordination)

*Construction Management Association of America (CMAA) Industry Report 2007*

37% of materials used in the construction industry become waste

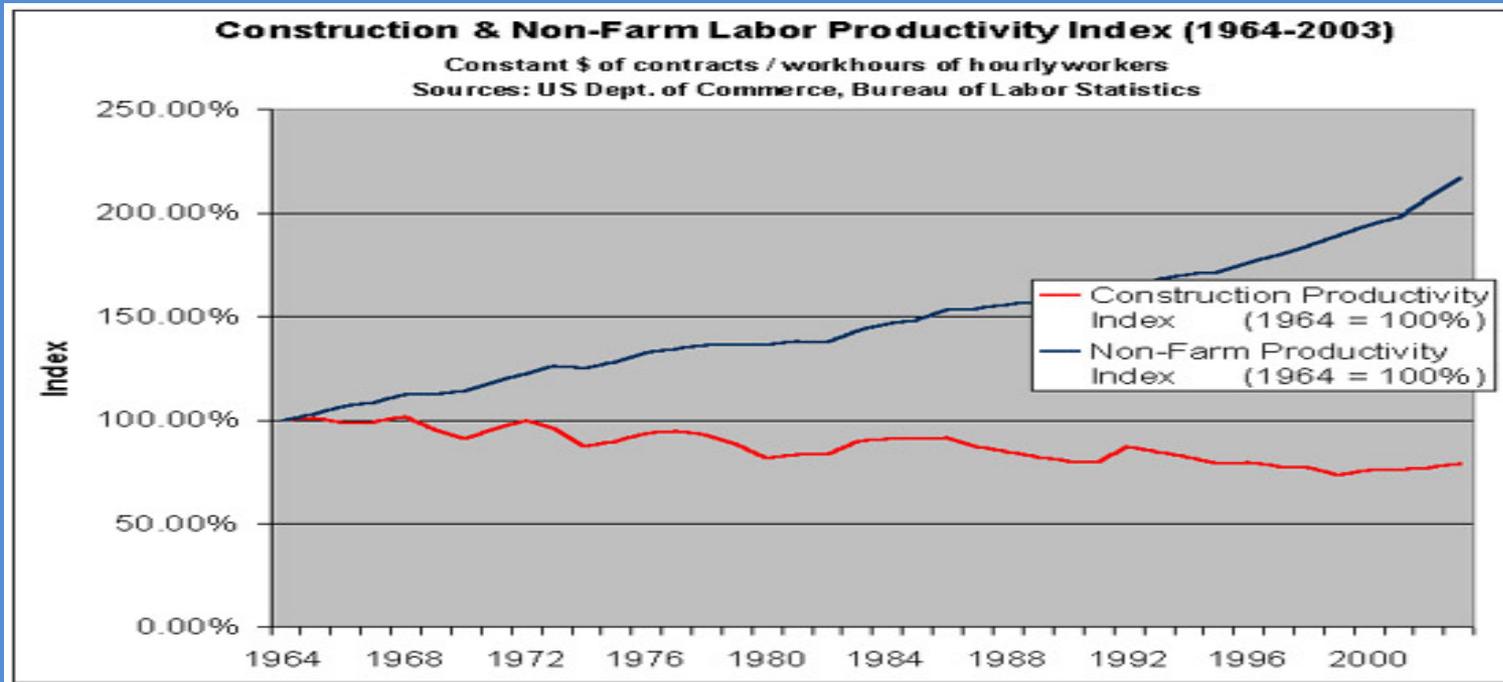
*Movement for Innovation Industry Reports - Economist Magazine 2002*

As much as 50% of design time is spend on needless (negative) iteration

*Lean Construction Institute's informal surveys of design teams*



The US Department of Commerce, Bureau of Labor Statistics tracking of the construction industry's productivity



As measured by dollars of new construction work / field work hour, labor productivity in the construction industry has trended downward over the past 40 years

- Totalling approx – 30% decrease over the past 40 years

In other words, construction projects have required significantly more field work hours per constant dollar of contract.

Much has been published about the four factors that can positively affect construction productivity.

They are:

- (1) utilization of life-cycle design and construction processes
- (2) utilization of technology
- (3) use of off-site fabrication and modularization and
- (4) availability of skilled labor



Utilization of technology, and BIM in particular, has been identified as extremely valuable tool to

- increase productivity of project teams and
- improve the quality control of built projects by
  - enabling critical communications and collaboration,
  - sharing of information between different parties,
    - to achieve high performance building goals
    - throughout a project's total life cycle of design, construction and operations

Those adopting new information technology

- tend to run in a stand-alone mode
- not encouraging collaboration and improved productivity by themselves or other members of the project team.

## OSA's current policy on Alternative Delivery Methods

Based on the State's Quality in Construction (QIC) Task Force 's work product.

- QIC was comprised of members from the design and construction industry and various state agencies which engage in building projects and met in 2004/5 and 2009/10

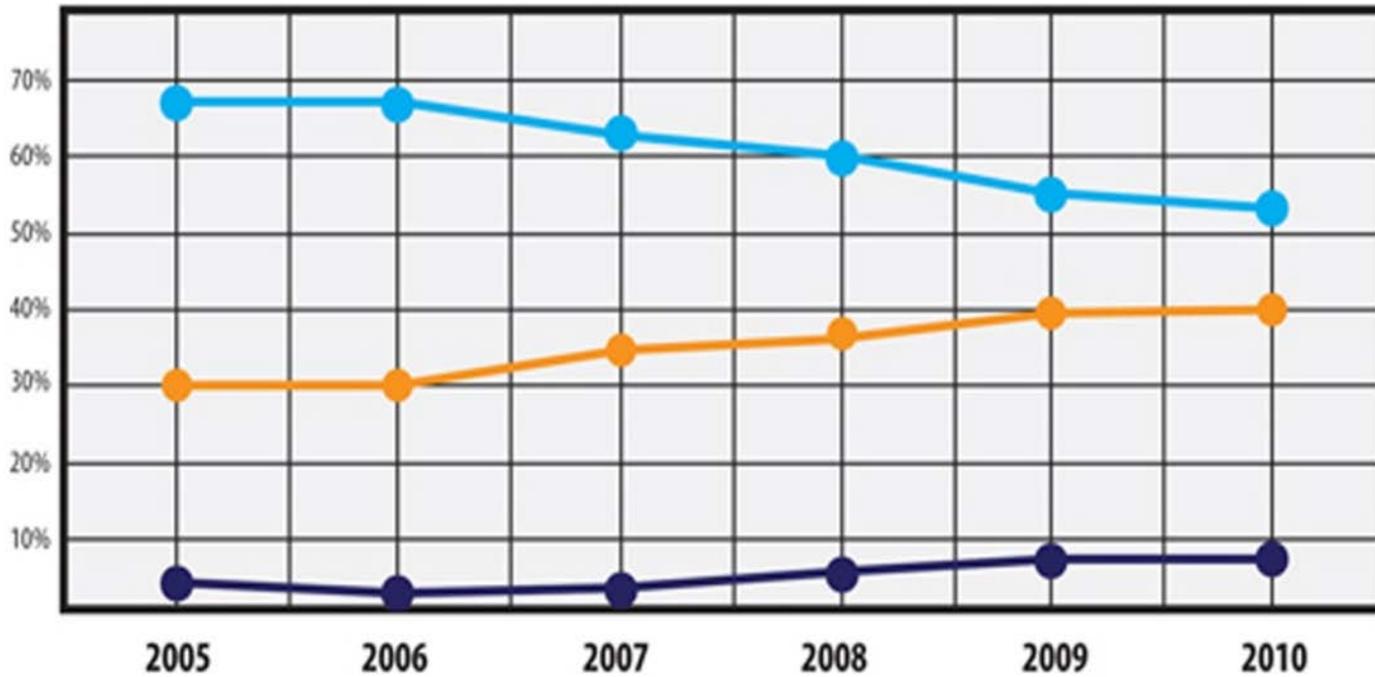
QIC identified various "alternative" delivery methods beyond D-B-B

- **Best Value 1, 2, and 3 (BV1, BV2, BV3)** - requires two part contractor submittal. BV1 allows a short listing of contractors based upon qualifications, the award is to the lowest responsible bid. BV2 and BV3 scores both qualifications and bid, allowing best qualified and not necessarily the lowest bid
- **Construction Manager/General Contractor (CM/GC)** - brings a contractor in early in the design process, providing pre-construction services, to work with the designer and owner to contribute to cost estimating, scheduling, and constructability reviews
- **Design-Build (D-B)** – provides a single point for responsibility by bringing the designer and contractor in at the same time under one contract

SBC Policy approved the use of these new Alternative Delivery Methods occurred in Dec. 2005

# Analysis of Construction Delivery Methods for U.S. Non-residential Vertical Construction

## Project Delivery Method Market Share for Non-Residential Construction



2005

67%  
D-B-B

30%  
D-B

3%  
CM/GC

2010

53%  
D-B-B

41%  
D-B

6%  
CM/GC

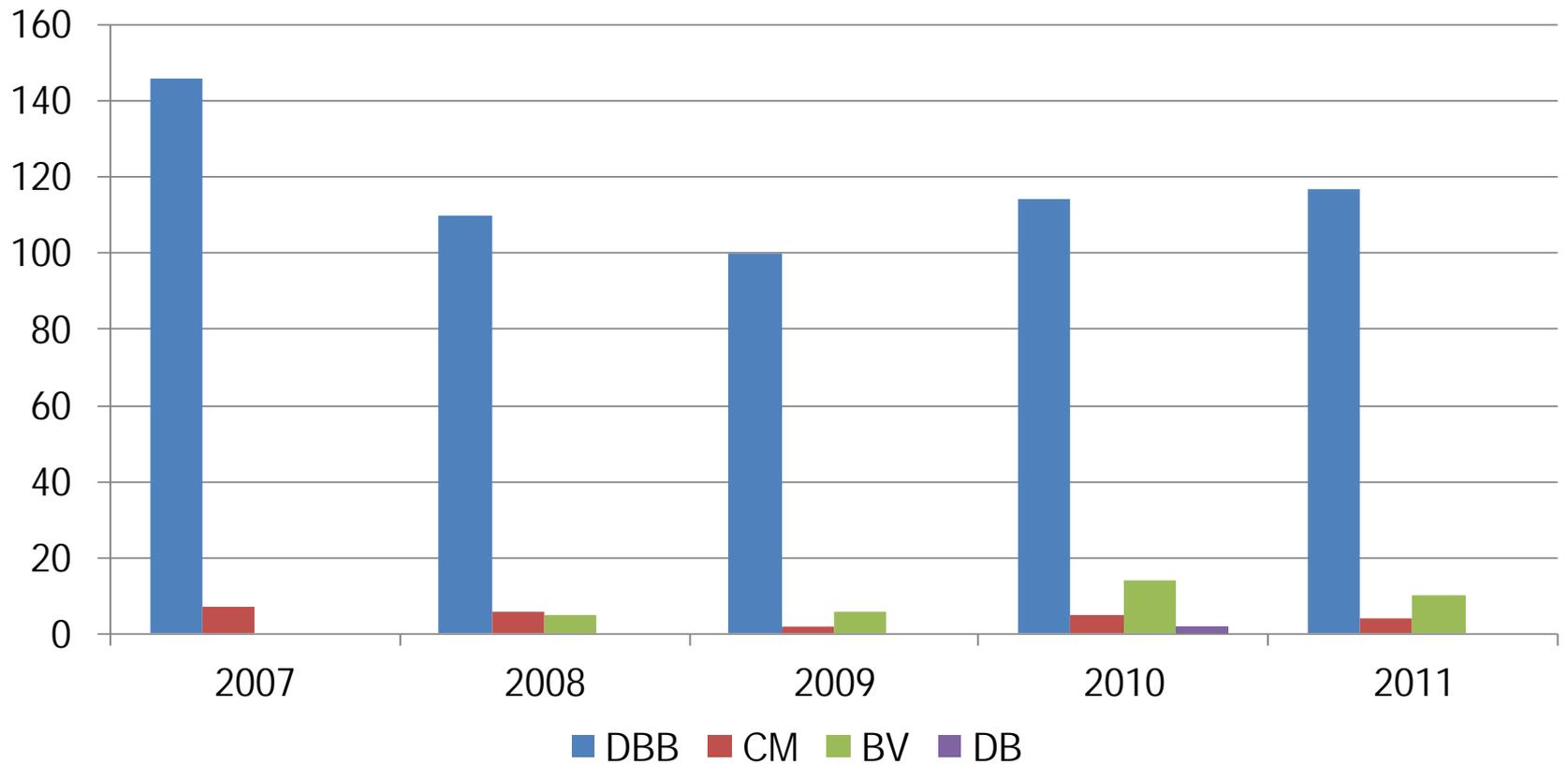
Analysis by RSMeans Business Solutions, a div. of Reed Construction Data

- Design-Build
- CM-at-Risk
- Design-Bid-Build

# Number of SBC Approved Projects

85-95% DBB

## GRAND TOTAL



## OSA's AEC Survey Results in 2012

1. Is your office's total volume of project construction delivery methods above the stated industry average in 2010 for each of the following delivery methods? (% of **total** responses)

	<u>Yes</u>	<u>No</u>
a. <b>53%</b> with D-B-B (including BV)	48%	52%
b. <b>41%</b> with D-B	12%	88%
c. <b>6%</b> with CM/GC	94%	6%

## OSA's AEC Survey Results in 2012

2. Would you encourage the State to consider expanding the use of alternative delivery methods (integrated design and construction team approach) in addition to D-B-B when appropriate?

Yes

100%

No

0%

## OSA's AEC Survey Results in 2012

3. How many of you believe that more integrated design and construction team alternative delivery methods will typically result in:

	<u>Yes</u>	<u>No</u>
Better coordinated design documents and final constructed projects	94%	6%
Higher performing buildings	85%	15%

## OSA's AEC Survey Results in 2012

4. Of the delivery methods being discussed, D-B-B • BV • DB • CM/GC • IPD, which delivery method would you expect will most often result in the **least** (% of **total** responses):

	<u>DBB</u>	<u>BV</u>	<u>DB</u>	<u>CM/GC</u>	<u>IPD</u>
a. RFIs	5%	15%	5%	50%	25%
b. Change Orders	5%	8%	5%	54%	28%
c. Time Delays	8%	10%	6%	57%	19%
d. Cost of Construction	28%	6%	2%	44%	20%
e. Cost of Operations	8%	13%	1%	46%	32%

## Reconvened Quality in Construction (QIC) Task Force – January 2013

Scope includes:

- Review original goals – included a feedback cycle regarding the use of Alternative Delivery Methods (ADMs) which include: Best Value, CM/GC, Design | Build
- Next steps
  - Review list of projects using each Alternative Delivery Method
  - Evaluate the application and effectiveness of each process
  - Propose revisions of criteria to evaluate use of each method
  - Refine State policies regarding use of these ADMs
- QIC may possibly request SPA approval to use current Alternative Delivery Methods (now just DBB) without prior SBC approval
- Consider defining additional Alternative Delivery Methods after completing first tasks above
  - Mentioned to date are 1) IPD , and 2) Public Private Partnerships

## Highly Collaborative Project Delivery Processes

Are project delivery processes that:

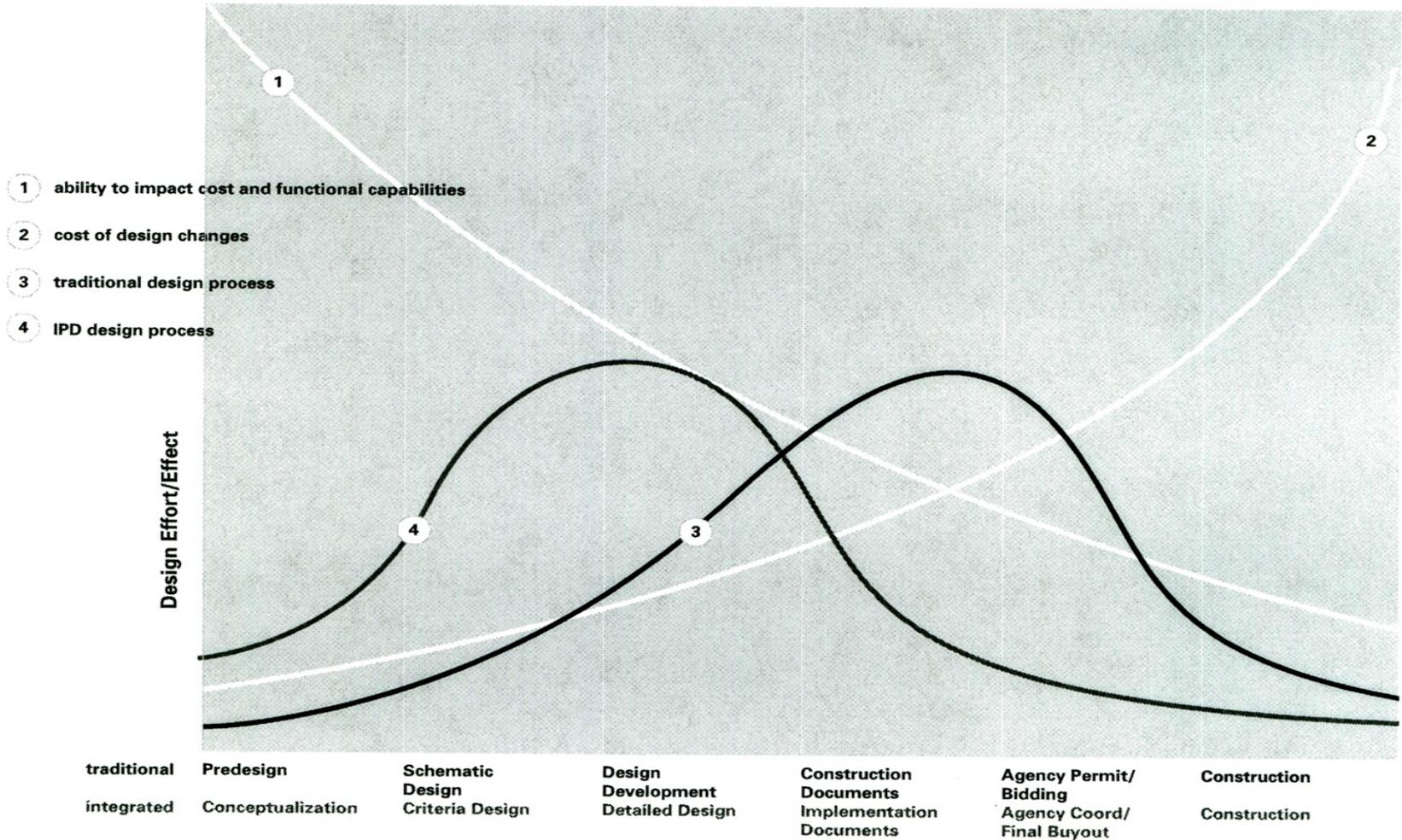
- Collaboratively harness the talents and insights of all participants
- Optimize project results:
  - Increase value to the owner
  - Reduce waste
  - Maximize efficiency through all phases of design, fabrication and construction

## Highly Collaborative Project Delivery Processes

These processes are distinguished by:

- Highly effective collaboration including at a minimum the Owner (users and O&M staff), designers and contractors
- Commence at early design including early contractor involvement for scope and budget definition as well as Life Cycle Cost Analysis, High Performance Building (Energy Efficiency) Goals and projected maintenance costs
- Continue through to project handover and preferably through first year warranty period

### Macleamy Curve



## Using Highly Collaborative Delivery Methods (not Design, Bid, Build)

Provides positive value propositions for the Owners, Designers (and consultants), and Contractors (and sub-contractors):

- *For Owners*
  - Allows the Owner to pre-plan projects utilizing industry best resources in defining project scope, budget and schedule prior to funding requests and approval
  - Allows High Performance Building goals to be considered and properly vetted
  - The integrated delivery process strengthens the project team's understanding of the owner's desired outcomes
  - Improves the team's ability to design to / control first costs
  - Increases the likelihood that project goals will be achieved
    - schedule
    - life cycle costs
    - quality

- *For Designers and Contractors*
  - Allows the contractor to contribute expertise for the Owner's, designer's and contractor's benefit early in the design process in:
    - construction techniques,
    - first and life cycle maintenance costs and
    - scheduling
  - This early contractor and subcontractor integration provides –
    - stronger pre-construction planning
    - more timely and informed understanding of the design by Owner and project team
    - pre-construction resolution of design-related issues
      - Reducing RFIs and Change Orders
    - visualization of construction sequencing prior to construction start
    - improved cost control and budget management
  - Results in improved project quality and financial performance during the design and construction phases and after occupancy by the Owner

## Use of Pre-Planning and Collaboration with Industry to Start Projects off Right and Provide a Better Opportunity for Projects to be Proceed as Intended

Owner performing Operational Pre-Planning before starting the design and construction process, including:

- Identifying industry standard expectations
- Developing project operations business case
- Owner setting Project Requirements including energy targets

Owner utilizing design and/or construction consultants to provide Design and/or Construction Pre-Planning when needed to finalize Owner expectations

- Collectively finalizing scope, schedule, budget, targeted energy consumption, building performance in pursuit of developing and operating High Performing Projects

## Reducing Waste in the form of Negative Iteration in the Design Process

By the LEAN Construction Institute (LCI)

- Iteration is essential for generating value in design processes
- However, not all iteration generates added value
- Informal surveys of design teams reveal estimates as high as 50% of design time is spend on needless (negative) iteration
- Other types of waste in design include
  - invalid design solutions based on less than the amount of needed knowledge needed to be valid (due to lack of collaboration with consultants and contractors) and
  - design errors

## Reduction of Waste Strategies

### Restructure the design process

- Break down batch processing into individual design tasks and re-sequence those smaller tasks by creating a “pull” schedule to determine which ones are needed when
- So each are done at the most appropriate time - when all the necessary information and decisions are in place - to perform each required individual task most efficiently

### Reorganize the design process

- Eliminate or reduce sequential silo decision making in favor of genuine team concurrent problem solving by cross-functional teams (users, operators, designers, consultants, contractors, subcontractors, suppliers, fabricators, etc.)
- Define / share the range of acceptable solutions amongst all decision makers in lieu of individuals competing for maximum priority of their criteria over others
  - Willingness to share incomplete information is necessary for concurrence in design

## Utilizing a Target Value Design Process

Re-work, re-pricing, change orders, and “de”value engineering are all symptoms of individual team members working in silos and misses the value added in an integrated project delivery solution.

- Rather than estimate based on a detailed design, design based on a detailed estimate.
- Rather than evaluate the constructability of a design, design for what is constructible.
- Rather than design alone and then come together for group reviews and decisions, work together to define the issues and produce decisions, then design to those decisions.
- Rather than narrow options to proceed with design, carry options farther into the design process.
- Rather than pushing for higher efficiencies of individual companies, components or systems of the project, focus on optimizing the whole project and project team

## Utilizing more efficient and effective Design / Construction / Operations Team Processes

LEAN Event – STREAM and TDEC pilot project

Included daily approval and decision maker representatives from

- STREAM and TDEC
- AEC industry
- State Fire Marshall's Office

Business Issue

- The length of time it takes to get a capital project through the system from the beginning of the design phase to completion of construction documents.

## Scope

### Starting point:

- Designer Agreement executed.

### Ending point:

- Project is advertised for Bids.

### Out of scope:

- Budget actions
- State Building Commission (SBC) project approval process
- Any non-TDEC project processes
- Internal approval processes of the
  - State Fire Marshal's Office (SFMO)
  - Aquatic Resource Alteration Permit (ARAP)



## Goals for Future State Process

- Reduce the amount of rework, hand-offs, variability, redundancies and delays in the current process.
- Clarify roles, responsibilities and accountabilities.
- Develop a streamlined operating procedure for TDEC's design phase processes.
- Identify elements of the new more collaborative process that might be utilized by other agencies.

## Future State Statistics

<i>Name of Process</i>			
	Current	Future	Improvement
Tasks	82	48	41%
Waits	29	13	55%
Handoffs	47	25	47%
Decisions	10	4	60%
Elapsed Time	29 – 72 weeks	12 – 32 weeks	17 – 40 weeks

## Benefits of Future State

- Condensed time frame.
- Less confusion, better scope definition earlier in the process.
- More key stakeholder buy-in.
- Transparency more widespread.
- Correct individuals have proper empowerment and accountability.
- Sharing and collaboration of documents and info, simplified approvals, tracking and reporting at all levels.
- Less stress on all parties.
- Less project drift, less stop and go.
- More consistency and higher quality projects.

## Bottom Line!

- Key Elements for Future
  - Taking unnecessary steps out of an inherently good process (e.g., redundant approvals)
  - Front-loading the process with in-depth programming and planning
  - Providing more comprehensive resources -- information, training
- Result?
  - **Dramatic reduction in elapsed time for design phase of State Capital Projects**
    - Simple projects should take 12 weeks instead of 29 (58% reduction).
    - Moderately complex projects should take 32 weeks instead of 72 (56% reduction).

## Upgrading our High Performance Building (HPB) Program Requirements

By making the right decisions during design and construction, reductions in operation and maintenance costs can be realized – often with little or not additional up-front costs

- Highly collaborative design – construction processes assist in achieving high performance building goals
- Design-Bid-Build (a sequential silo delivery process) prohibits early contractor involvement and collaboration with the design team

2003 State of California's "The Costs and Financial Benefits of Green Buildings" concluded after ten years of research that minimal increases in upfront costs of about 2 percent would, on average, result in life cycle savings over a 10 year period of 20 percent of total construction costs

- Example - \$10,000 up-front investment on a \$5 mil project would result in a savings of \$1 mil in today's dollars over the (ten year) life of the building"

## OSA HPB Consultant Work

To date:

- Held Town Hall / Webinar – HPB Kickoff visit
- Completed survey to assess Designer's project experience with SDG
- Established HPB Working Group(s)

## OSA's AEC Survey Results in 2012

### High Performing Building Designs

5. What % of your office's annual projects do you consider to be high performing building designs (more energy efficient than required by energy codes, etc.)?

Less than 60%

57%

Greater than 60%

43%

6. Do you believe that high performing building designs can lower the total cost of ownership of:

	<u>Yes</u>	<u>No</u>
Energy (via energy modeling, commissioning, M&V, low flow, etc.)	96%	4%
Maintenance (via IPD methods, BIM and data sharing, performance specs, etc.)	98%	2%



## OSA HPB Consultant Work

- Developing new HPB Requirements including (continued):
  - Other High Performance Building design performance criteria
    - Including Life Cycle Cost Analysis (LCCA) requirements (new)
    - Use of Local / Regional Materials (expanded)
- Simultaneously developing new DGS / STREAM project specific pre-planning criteria including:
  - Owner's HPB expectations for each project to be documented in new Owner's Project Requirements (OPR)
    - During April through June of 2013 we will be developing HPB pre-planning content for all upcoming DGS FY 13-14 prioritized projects, and
    - Similarly, starting in April 2013 we will be working on FY 12-13 or earlier priority projects which are already funded but not yet started

## OSA HPB Consultant Work

- Issue new HPB Requirements (formerly called SDG) – target date July 2013
- Next HPB town hall meeting re: content update –July 2013?

## Future:

- Conduct training for State Project Managers (summer)
- Second release of HPB Requirements - including additional tiers of performance targets to be written in FY 2013-14 (starting July 2013)

## Utilizing Building Information Modeling during Design and Construction

According to 2009 McGraw Hill Construction's report "The Business Value of BIM"

Owners say BIM projects have greater value due to

- Improved collective understanding of design intent
- Improved coordination of drawings / documents
- Better cost control / predictability of project scope
- Improved overall project quality
- Reduced number of RFIs (Requests for Information) and Change Order
- Reduced conflicts during construction
- Avoiding construction rework / changes
- Faster project delivery
- Providing data useful post construction for Operations and Maintenance

## OSA BIM Consultant Work

To date:

- Completed survey to assess AEC industry project experience with BIM
- Held Town Hall / Webinar – BIM Kickoff
- Established an industry BIM Working Group – to review and comment on draft documents
- Finalized initial draft of BIM Standards - January 2013
  - Finalized Owner's O & M criteria (based on COBie Guide)
- Reviewed and incorporated comments from UT, TBR, and STREAM
- Reviewed and incorporated comments from AEC industry attorneys, insurance and surety reps

# OSA's AEC Survey Results in 2012

## Building Information Modeling

7. Are any of your projects (including work provided by other members of the design and construction team) being designed or constructed utilizing BIM on a daily basis?

<u>Yes</u>	<u>No</u>
56%	44%

8. Would you support a Public Owner's BIM program for use by a project's design and team members?

<u>Yes</u>	<u>No</u>
89%	11%

9. For those of you using BIM, are you currently/have you used BIM on projects within the past year for the:

	<u>Yes</u>	<u>No</u>
Private Sector	75%	25%
Public Sector	67%	33%

## OSA BIM Consultant Work

### Next steps:

- We will be finalizing our internal review and approvals and are targeting release of version 1 before May 1, 2013
- Once approved and released
  - Hold another BIM town hall meeting re: Overview of BIM Requirements (early summer)
  - Conduct training on Design and Construction BIM Usage with State Project Managers (early summer)
  - Conduct training on Operations & Maintenance BIM Usage with State Facility Managers (later in FY 13-14)
  - Offer AIA Convention Workshops on implementing State of TN BIM Requirements – open to AEC industry (August 14, 2013)

## Bottom Line!

A holistic and proactive outcome-based approach to design, construction, operations, maintenance and facilities management with emphasis on accountability, and continuous improvement will result in

- higher performing building projects throughout their entire life-cycle
- which are more efficient and effective to operate and maintain, and have a lower Total Cost of Ownership

## 2013-14 Capital Budget Requests to Governor – November 2012

### Related Links

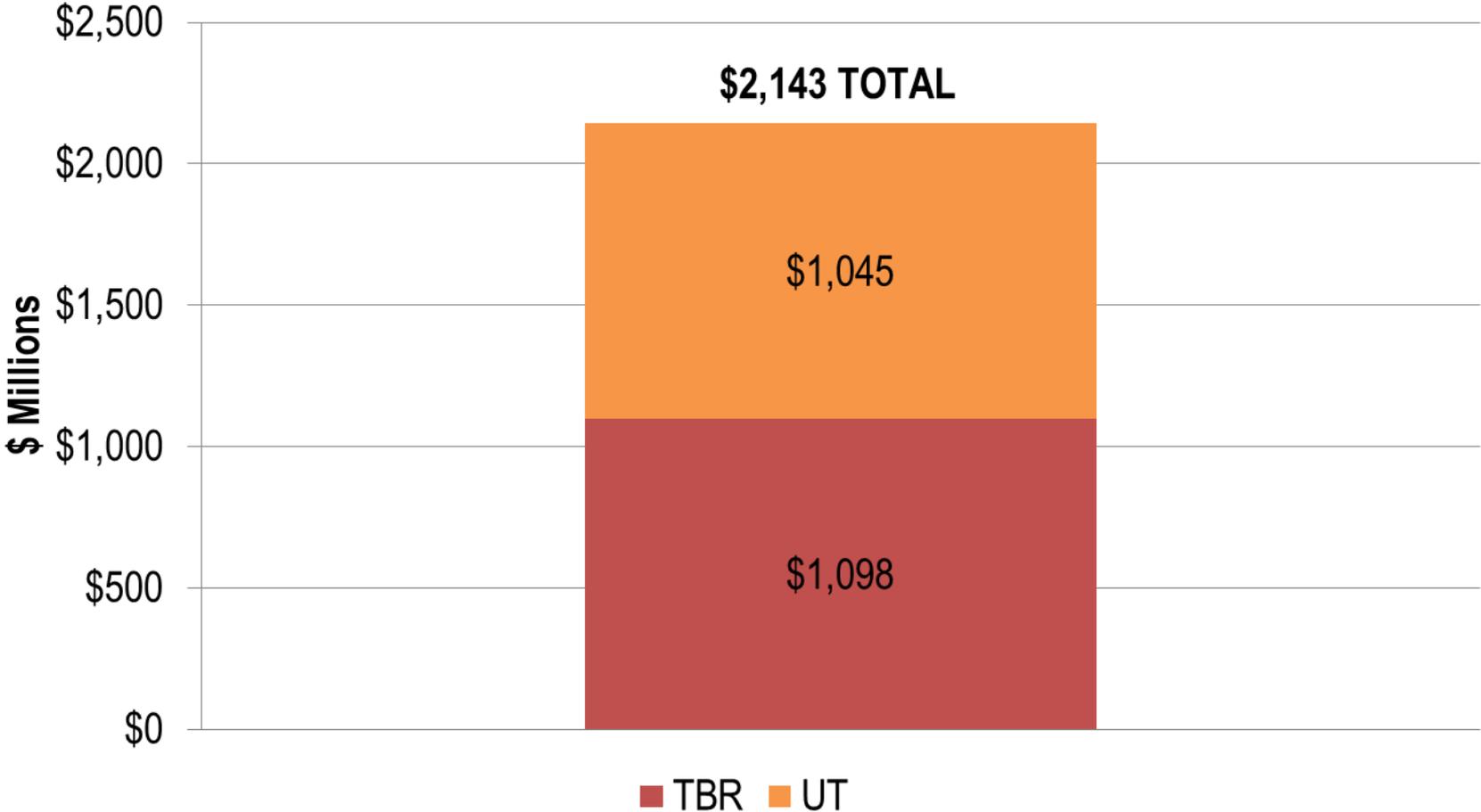
#### 2013-14 Governor's Proposed Capital Project Listing

<http://www.tn.gov/finance/OSA/documents/2013-2014capitalbudget.pdf>

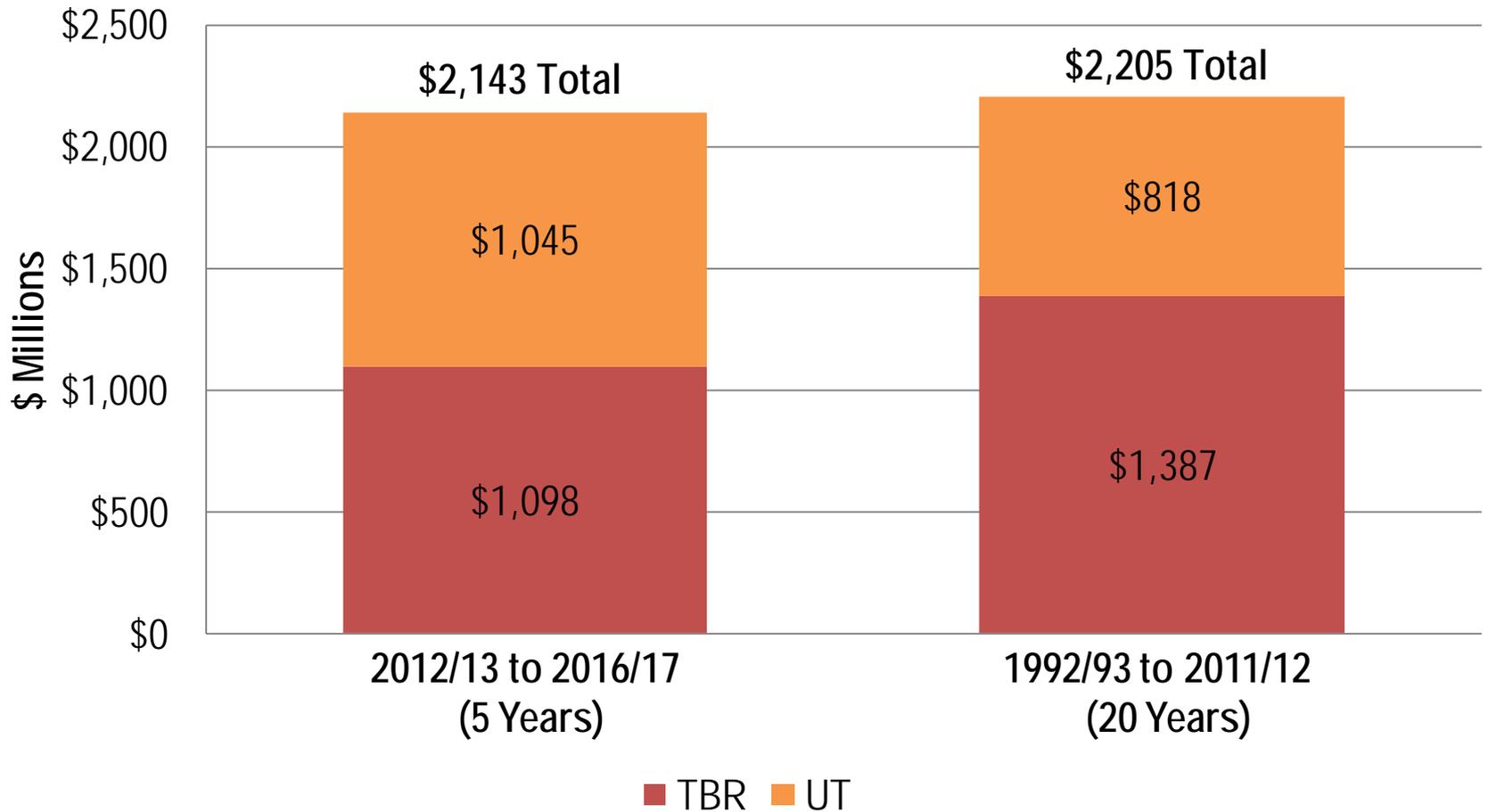
#### **THEC 2012-13 Capital Projects Recommendation & Five-Year Capital Projects Plan**

<http://nowuseeit.state.tn.us/mediasite5/Catalog/pages/catalog.aspx?catalogId=689c9469-0a03-44b1-92fc-b105724a9d9f>

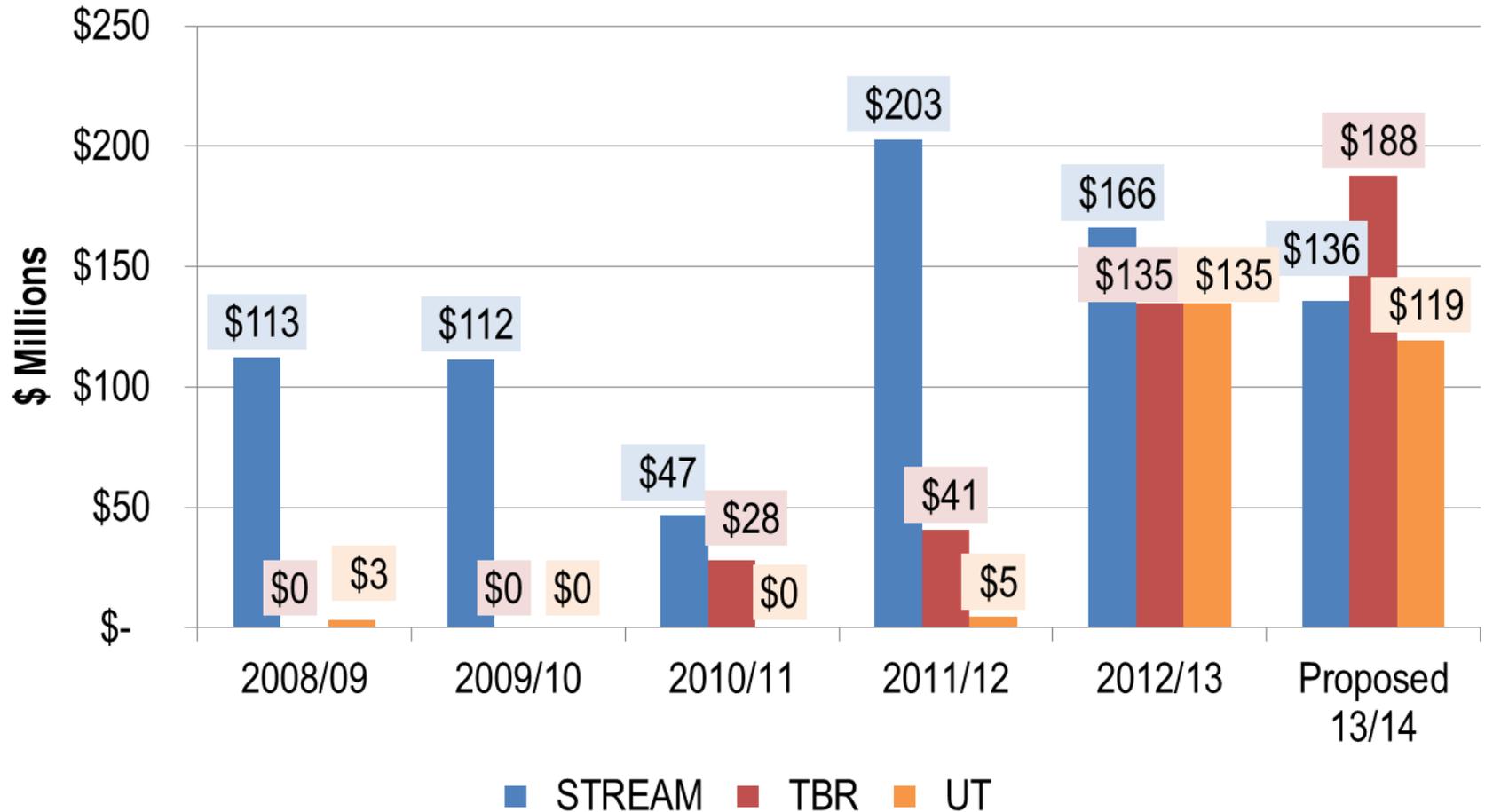
# Five-Year Total Capital Investment



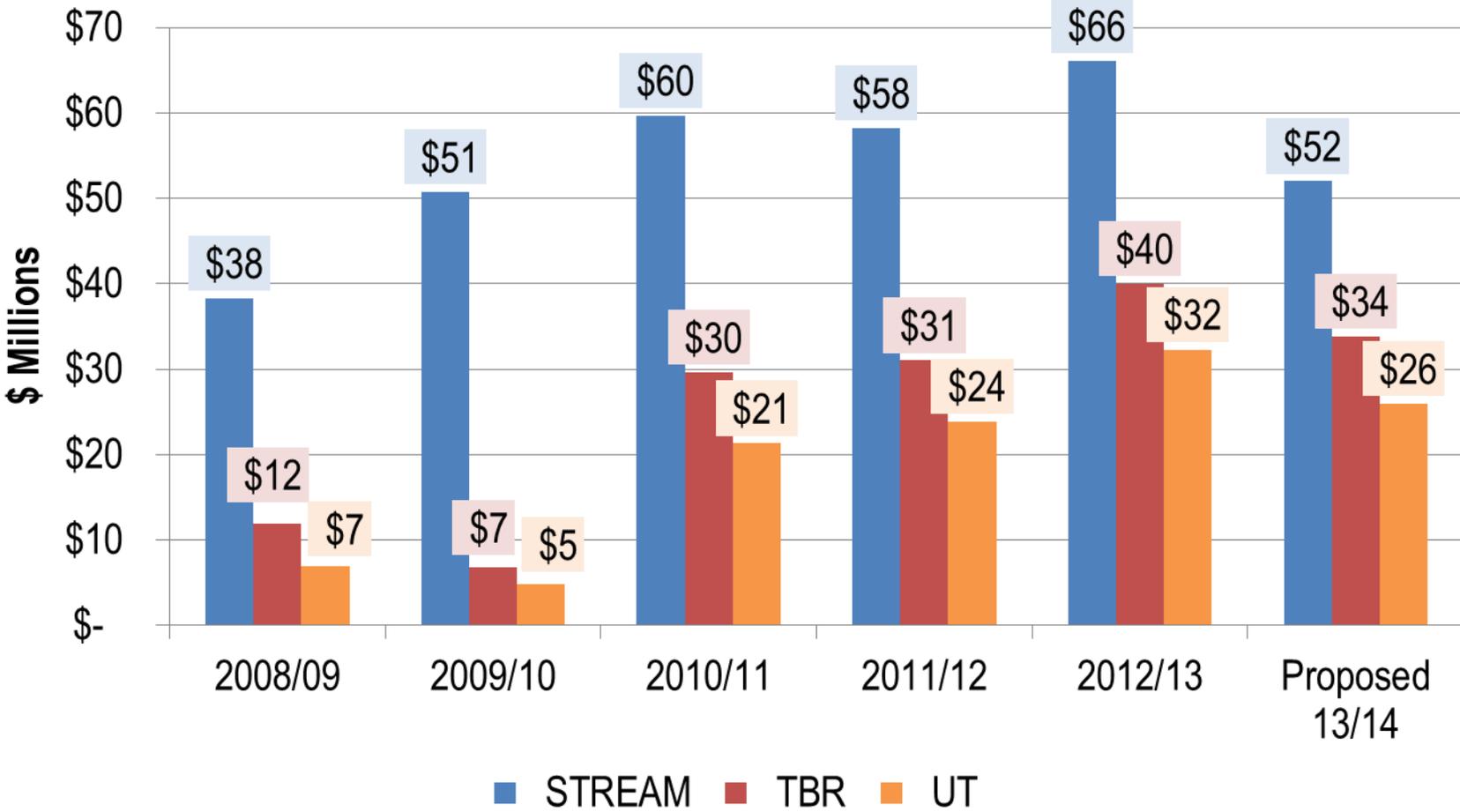
# Total Capital Investment



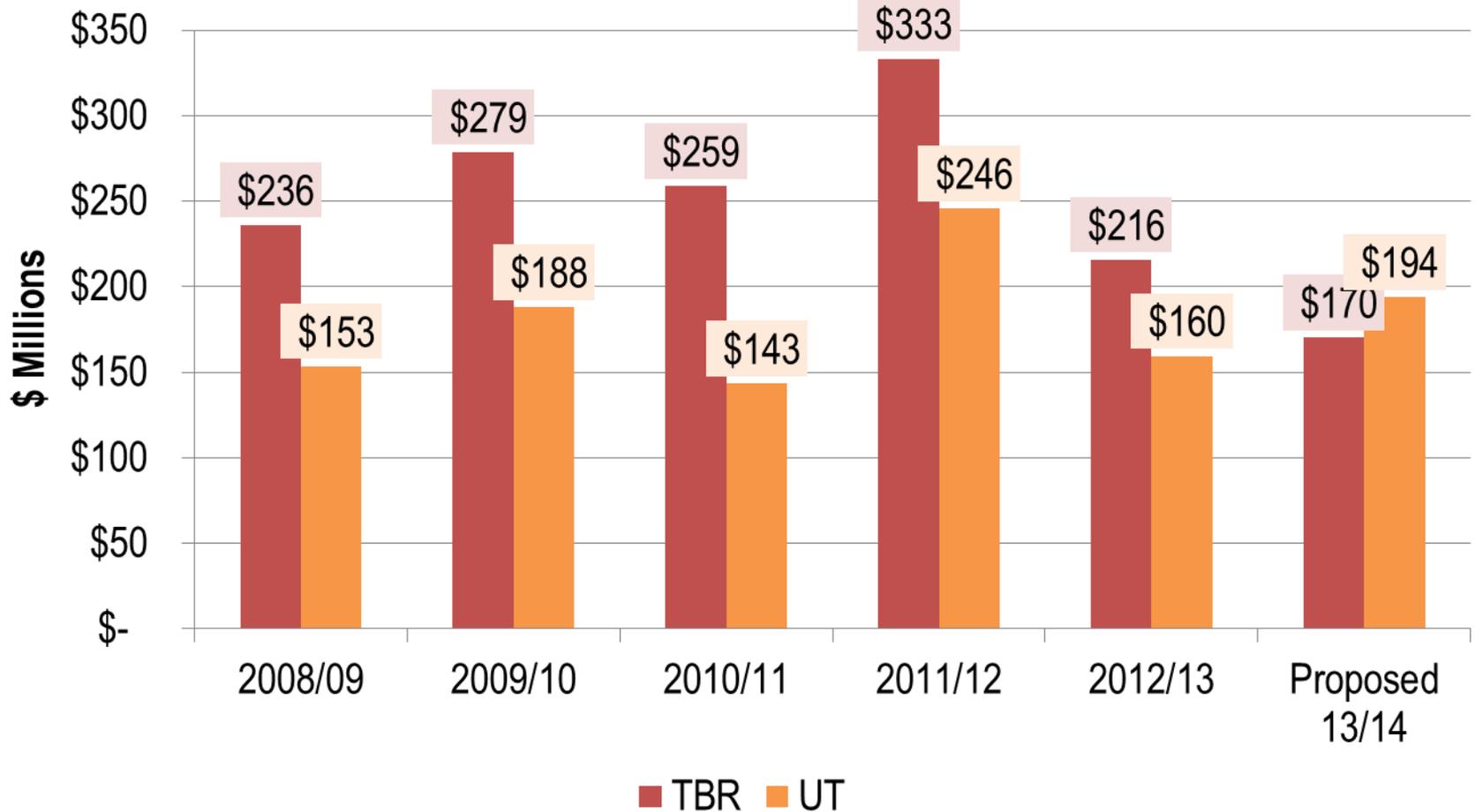
## Capital Improvements



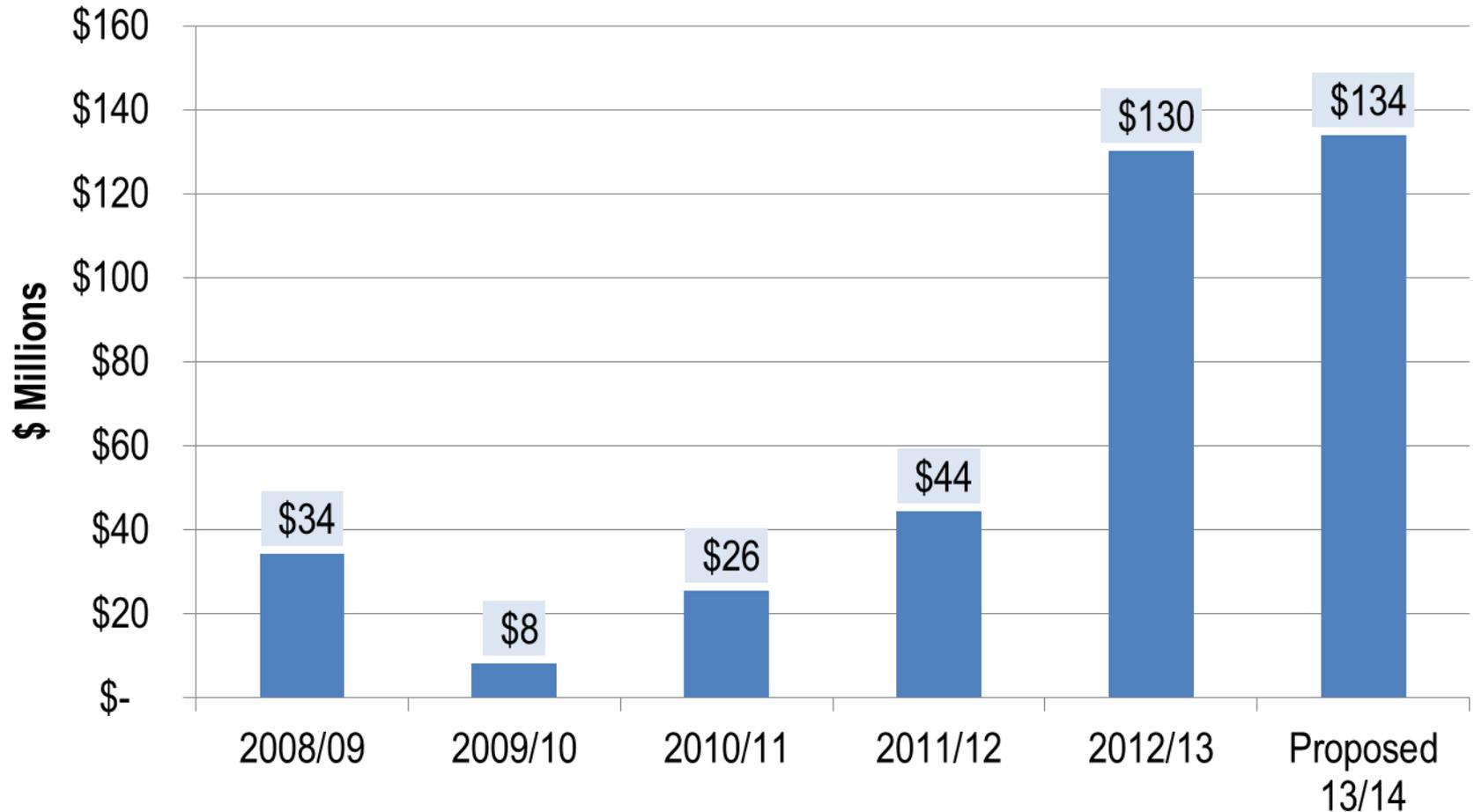
# Capital Maintenance



## Capital School Bonds and Other Sources



## Facilities Revolving Fund - STREAM



## Capital Budget Grand Total

