

Construction Economics Research Network  
Washington, D.C.

# Forecasting Construction Labor Demand: A Working Model?

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December 6, 2007

# Perspective -- Creating a Skilled Trades Forecast

- MHC collects data on projects in planning, following those projects until they are abandoned or start. Projects that start are entered into a contract awards database
- MHC Research and Analytics produces detailed construction forecasts, primarily for building products manufacturers to help them analyze and plan their markets.
- A natural extension is to use the same forecasts to help contractors and unions assess demand for the skilled trades.

# Current Labor Demand Forecasts

- Bureau of Labor Occupational Employment Outlook
- Employment Development Departments (California and selected states)
- Construction Labor Research Council
- Construction Sector Council (Canada)  
Construction Labour Market Information (LMI) Program

- **Objective:** Forecast demand for the skilled construction trades based on projected construction activity
- **Major Challenges:**
  - Find way of estimating utilization rates for the skilled trades by building type so that different types of construction activity affect demand for the trades differently
  - Adapt US rates to regional or local economies
  - Allow for the volatile nature of construction activity so that the demand for the trades does not appear smoothly increasing or decreasing

# Occupational Employment Surveys

- Provide employment, wages, and wage rates for 800 standard occupation classifications, including 58 in the skilled construction trades, (i.e, carpenters, roofers, electricians, carpenters helpers, etc.).
- Survey of establishments with payroll.
- Provide totals for the US, states, and selected metropolitan areas.
- Conducted once a year with sampling done on a rolling basis.

# Skilled Trades by Industry

(US Wages by Industry, Millions of Dollars, 2002)

Skilled trades	building construction industries		heavy construction industries		crafts & specialty trades industries		totals		
	home builders	commercial/ industrial builders	highway builders		framing contractor	masonry contractors			
boilermakers	7	250	.	2	.	24	44	.	771
brick masons	79	364	.	12	.	20	3,335	.	4,443
carpenters	4,125	5,115	.	691	.	1,825	96	.	26,742
electricians	64	392	.	26	.	5	0	.	18,856
.	.	.	.	.	.	.	.	.	.
construction laborers	1,071	2,981	.	3,079	.	289	996	.	20,546
carpenters - helpers	374	383	.	38	.	134	0	.	2,079
.	.	.	.	.	.	.	.	.	.
construction wages	6,594	12,850	.	8,059	.	3,515	5,801	.	147,647

# Census of Construction Industries

- Detailed statistics on U.S. construction activity, building products and labor inputs for thirty NAICS industry firm types
- All Employees of a firm are classified in that industry – but firm types do not = skilled trades
- Conducted every five years with results published about three years later (2002 most recent).
- Covers firms with payroll.
- Thirty construction industries divided into three sectors
  - Building Contractors (six industries)
  - Heavy/Engineering Contractors (six industries)
  - Specialty Trade Contractors (eighteen industries)

# Census of Construction Industries

- Building Construction
  - New Single Family Construction General Contractors (NAICS 231665)
  - New Housing Operative Builders
  - (Six in total)
- Special Trades Construction
  - Poured Concrete Foundation & Structure Contractors (NAICS 238110)
  - Structural Steel and Precast Concrete Contractors (NAICS 238120)
  - Framing Contractors (NAICS 238130)
  - (Eighteen in total)
- Heavy & Civil Engineering Construction
  - Water & Sewer Lines & Plants (NAICS 236115)
  - Oil & Gas Pipelines & Related Structure (NAICS 237120 )
  - Power & Communications Lines & Related Structures (NAICS 237130)
  - (Six in total)

# Building Types by Industry

(US Construction by Industry, Millions of Dollars, 2002)

Census of Construction – Industry Firm Types

Building types	building construction industries		heavy construction industries		crafts & specialty trades industries			totals
	home builders	commercial/ industrial builders	highway builders	framing contractor	masonry contractors			
.	.	.	.	.	.	.	.	.
stores	302	38,547	88	339	96	.	58,798	
offices	317	46,451	99	328	0	.	74,289	
.	.	.	.	.	.	.	.	
schools	634	41,041	220	134	0	.	68,975	
hospitals	241	22,985	84	249	996	.	35,231	
.	.	.	.	.	.	.	.	
highways	56	1,058	46,136	3	72	.	55,721	
drinking water	35	487	1,622	2	5,801	.	18,511	
.	.	.	.	.	.	.	.	
<b>total construction</b>	<b>96,018</b>	<b>229,137</b>	<b>68,974</b>	<b>14,117</b>	<b>18,053</b>	.	<b>1,061,147</b>	

# Carpenters' Contribution to Store Construction

(US Totals, in Millions of Dollars, 2002)

Construction Industries	wages paid to carpenters	stores as proportion of industry output	carpenters wages for store construction
homebuilders	4,125	0.3%	12
. commercial/institutional builders	. 5,115	. 16.8%	. 859
. highway builders	. 691	. 0.1%	. 1
. framing contractors	. 1,825	. 2.8%	. 51
masonry contractors	96	7.2%	7
. total	. \$ 26,742	. 6.1%	. \$ 1,619

# Skilled Trades by Building Type

(US Wages by Industry & Building Type, Millions of Dollars, 2002)

Skilled trades	Building types								
	stores	offices	.	schools	hospitals	.	highways	drinking water	totals
boilermakers	77	93	.	91	46	.	19	23	771
brick masons	335	343	.	608	182	.	52	39	4,443
carpenters	1,619	2,156	.	1,959	935	.	770	208	26,742
electricians	1,982	3,320	.	1,975	1,292	.	666	151	18,856
.	.	.	.	.	.	.	.	.	.
construction laborers	1,110	1,222	.	1,358	617	.	2,955	848	20,546
carpenters - helpers	119	153	.	234	68	.	51	15	2,079
.	.	.	.	.	.	.	.	.	.
construction wages	10,302	14,305	.	1,263	6,221	.	9,409	2,963	147,647

# U.S. Skilled Trades by Building Type

(US Wages, Percentages of Total Construction Cost, 2002)

Skilled trades	Building types								
	stores	offices	.	schools	hospitals	.	highways	drinking water	totals
boilermakers	0.1%	0.1%	.	0.1%	0.1%	.	0.0%	0.1%	0.1%
brick masons	0.6%	0.5%	.	0.9%	0.5%	.	0.1%	0.2%	0.4%
carpenters	2.8%	2.9%	.	2.8%	2.7%	.	1.4%	1.1%	2.5%
electricians	3.4%	4.5%	.	2.9%	3.7%	.	1.2%	0.8%	1.8%
.	.	.	.	.	.	.	.	.	.
construction laborers	1.9%	1.6%	.	2.0%	1.8%	.	5.3%	4.6%	1.9%
carpenters - helpers	0.2%	0.2%	.	0.3%	0.2%	.	0.1%	0.1%	0.2%
.	.	.	.	.	.	.	.	.	.
<b>total</b>	<b>17.5%</b>	<b>19.3%</b>	<b>.</b>	<b>18.3%</b>	<b>17.7%</b>	<b>.</b>	<b>16.9%</b>	<b>16.0%</b>	<b>13.9%</b>

- **Objective: Adjust demand estimates for the skilled trades for local and regional differences in building practice.**
- **Problem: Not all the data needed to create U.S. estimates for skilled trade demand is available at local level.**
  - Occupational Employment Surveys – skilled trade jobs by NAICS industry – are available for states and metropolitan areas, but
  - Census of Construction reports (NAICS industry to building type) are not, but McGraw-Hill Construction Contract Awards can be used instead.

# Rebalancing a Table

- **Well-established and widely used technique to adjust matrix for new information.**
- **Scales individual entries in the table to new row and column totals, adjusting the pattern of relationships among individual entries.**
- **Appropriate Uses --**
  - Adjust national rates for regional differences, for example higher usage of bricklayers in the southeast.
  - Force tables with older data, for example Census of Construction (2002), to conform to newer employment and construction data.

# Data for Rebalancing Table

- Occupational Employment Survey data for states and large metropolitan areas for most recent historical years.
- McGraw-Hill Construction construction activity for counties summed to states and large metropolitan areas for most recent historical years.
- Result: a new skilled trades potential table configured for relevant geography and year *and* scaled to construction activity.

# Rebalanced Table -- New Jersey Skilled Trades by Building Type

(NJ Wages, Percentages of NJ Construction Cost, 2002, scaled)

Skilled trades	Building types								
	stores	offices	.	schools	hospitals	.	highways	drinking water	simple average
boilermakers	0.1%	0.1%	.	0.1%	0.1%	.	0.0%	0.2%	0.1%
brick masons	0.6%	0.4%	.	0.9%	0.5%	.	0.1%	0.3%	0.7%
carpenters	3.2%	2.8%	.	3.3%	3.0%	.	1.7%	1.6%	3.9%
electricians	5.7%	6.7%	.	5.2%	7.0%	.	2.3%	1.8%	6.0%
.	.	.	.	.	.	.	.	.	.
construction laborers	2.1%	1.6%	.	2.4%	2.0%	.	6.8%	6.9%	4.6%
carpenters - helpers	0.1%	0.1%	.	0.2%	0.1%	.	0.1%	0.1%	0.2%
.	.	.	.	.	.	.	.	.	.
<b>total</b>	<b>20.3%</b>	<b>20.3%</b>	.	<b>22.6%</b>	<b>21.0%</b>	.	<b>23.4%</b>	<b>28.3%</b>	<b>20.7%</b>

# The Construction Forecast

MHC Research and Analytics takes a multi-level approach to forecasting construction

- Create a national economic forecast and flow the results to regions, states and metropolitan areas
- Apply construction models to regional, state, and metropolitan areas to forecast construction activity for twenty-two building types
- Incorporate large project forecasts.
- Push large projects and state/ metropolitan forecasts down to the county level

# MHC Building Types

## Project types:

- **Commercial:** Stores, warehouses, offices, hotels, garages/service
- **Institutional:** Healthcare, education, dormitories, amusement, religious, miscellaneous nonresidential
- **Public:** Prisons, capitols and courthouse, public safety buildings
- **Residential:** Single family, multifamily housing
- **Heavy & Highway:** Streets/highways, bridges, sewers, water supply, dams/water resources, miscellaneous transportation, manufacturing, utilities

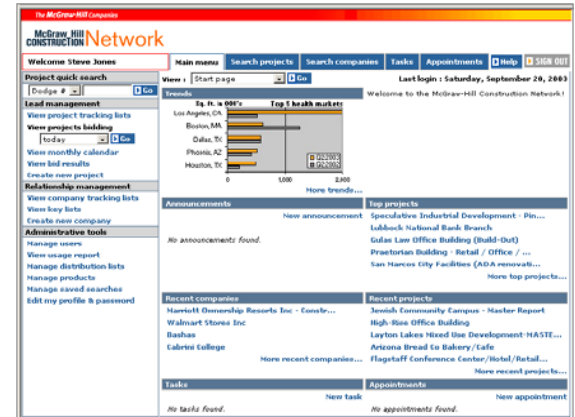
# MHC Construction Forecasting

- **Forecasting models** based on a comprehensive historical database available, updated quarterly
- **Econometric models** for 22 major project types at the national and regional levels
- **State and metropolitan area models with share-down methodology for counties**
- Expertise in determining
  - **the percentage of planning/bidding projects that will ultimately reach start (within 5 years), and**
  - **the length of time to start for projects in prior stages of development**

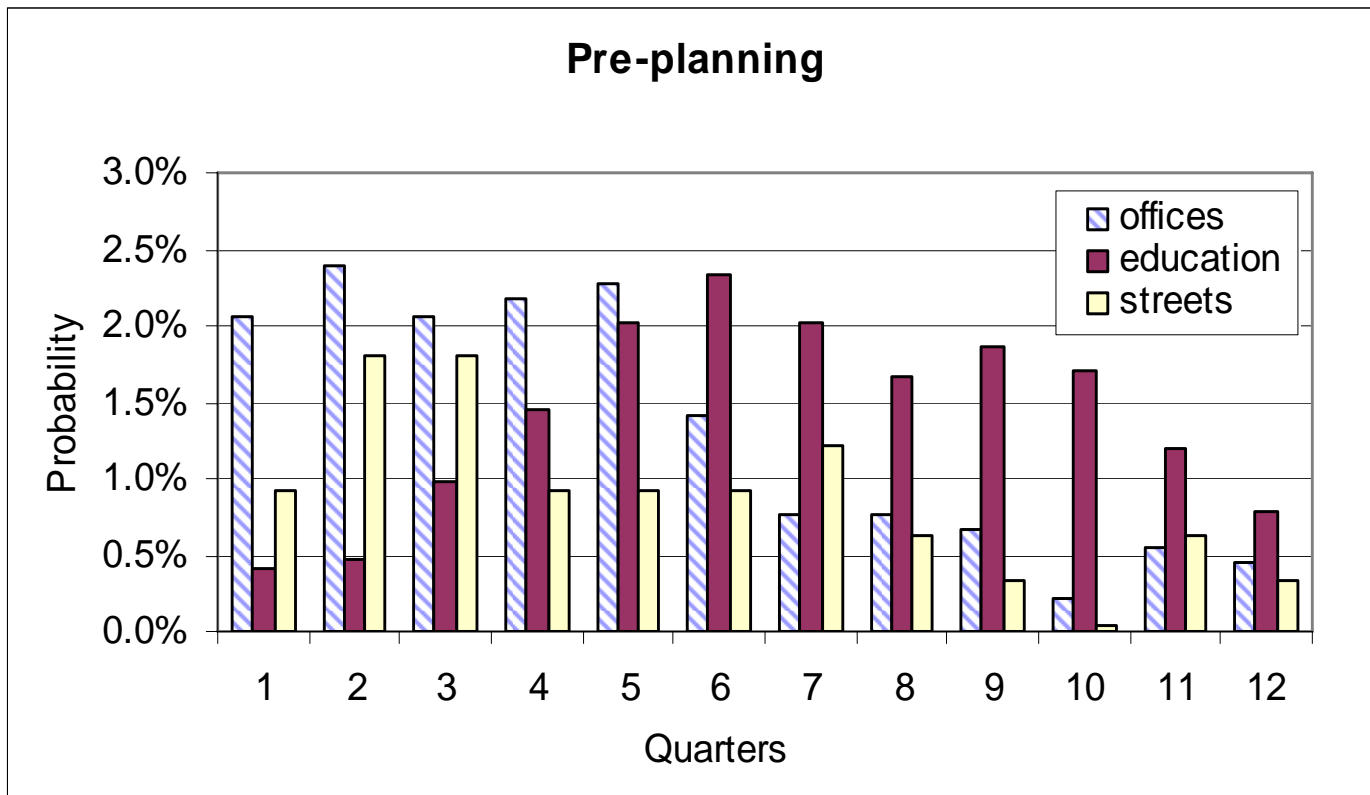
# Incorporating Individual Projects



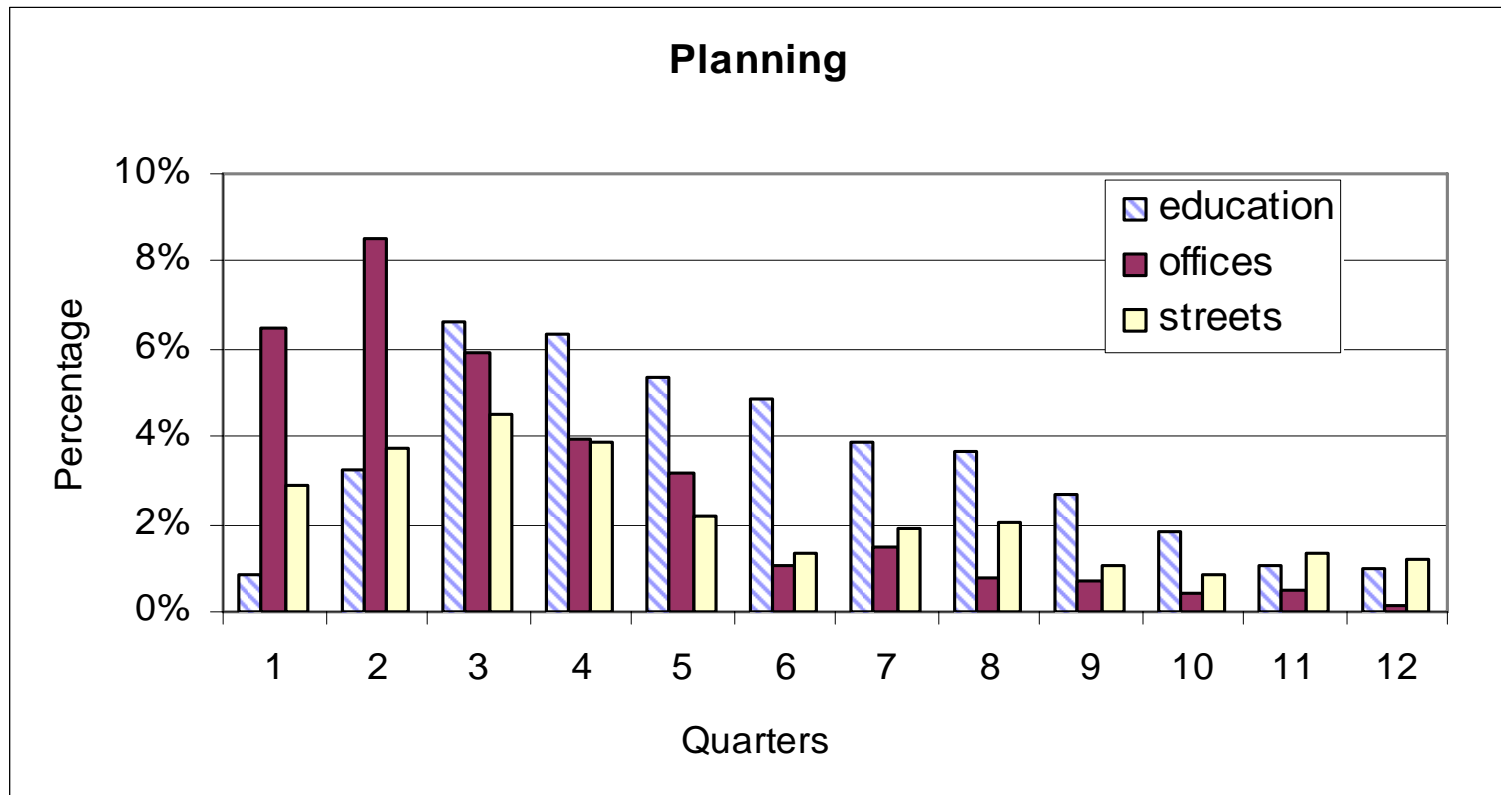
- Collect projects in the various planning stages from Dodge Reports and the MHC Construction Network
- Project those projects to construction start
- Reconcile projects with state and metropolitan level forecasts



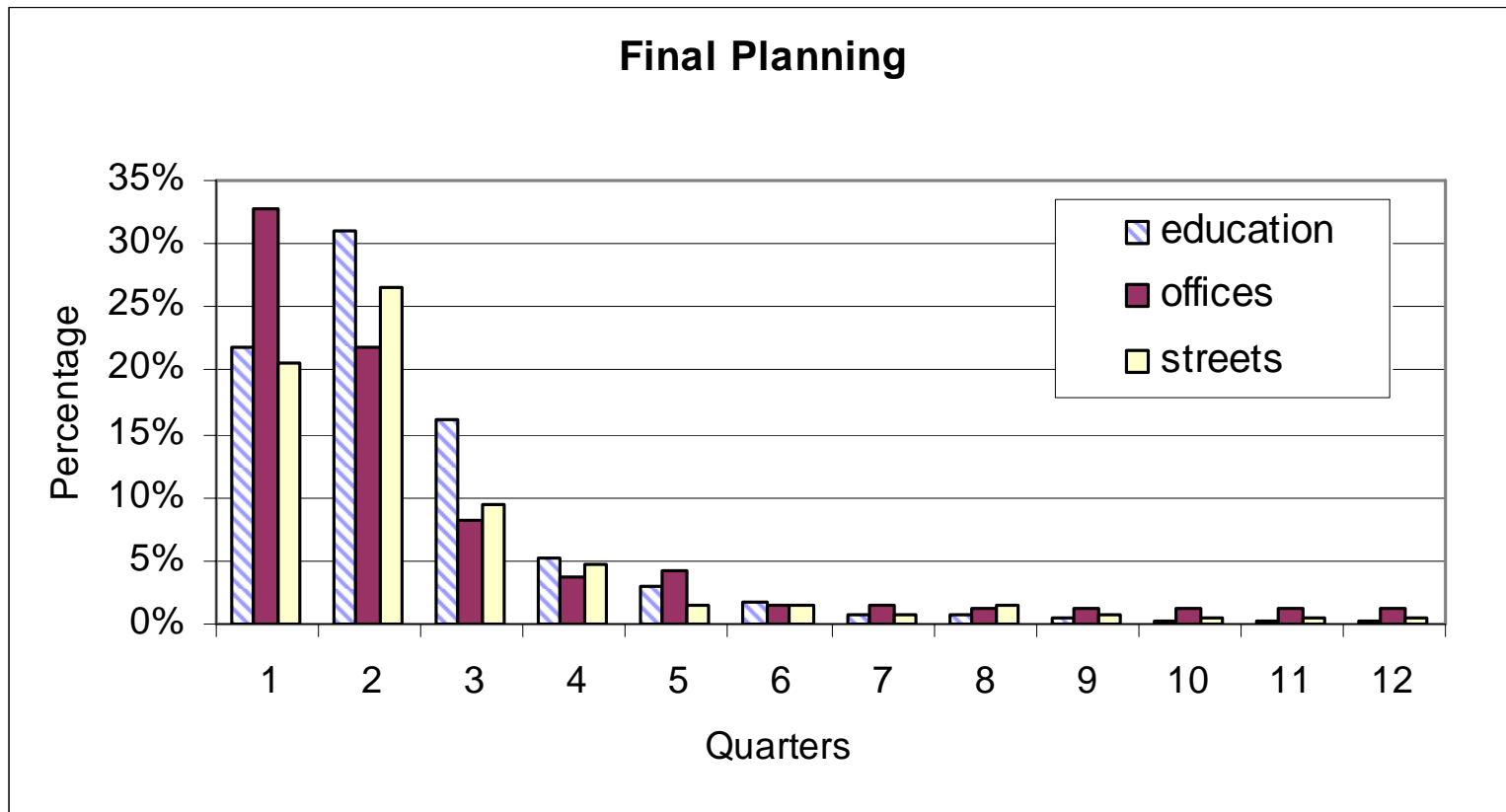
# Time Lags and Probabilities Between Planning and Construction Start



# Time Lags and Probabilities Between Planning and Construction Start



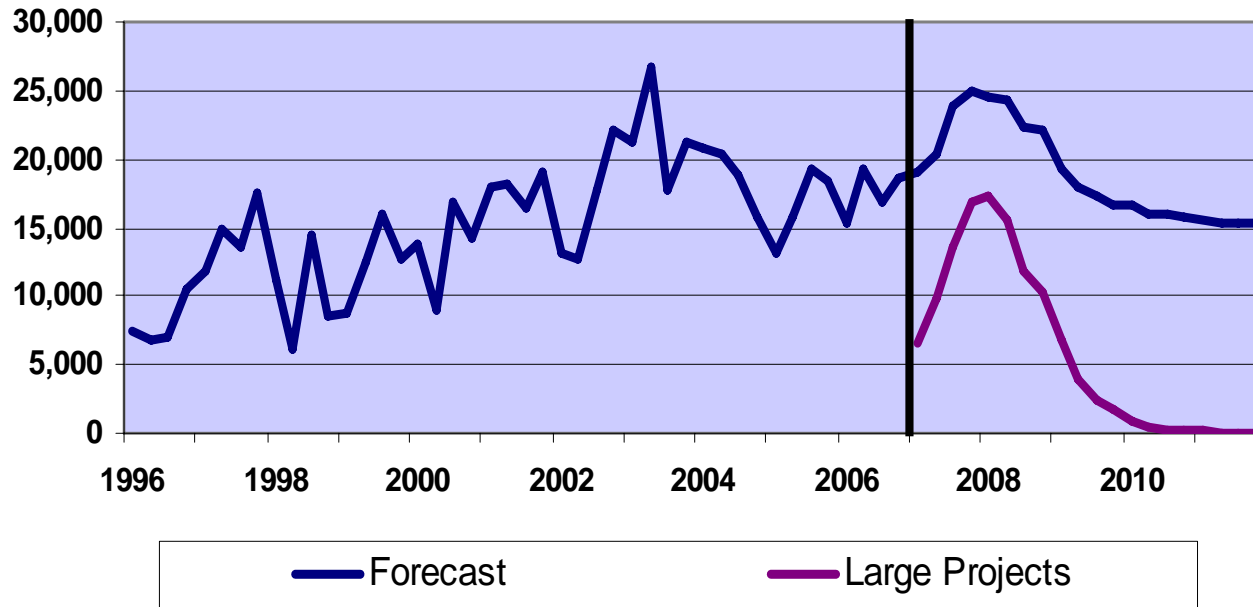
# Time Lags and Probabilities Between Planning and Construction Start



# Forecast Detail

## Education Buildings in California

Thousands of Square Feet (SAAR)



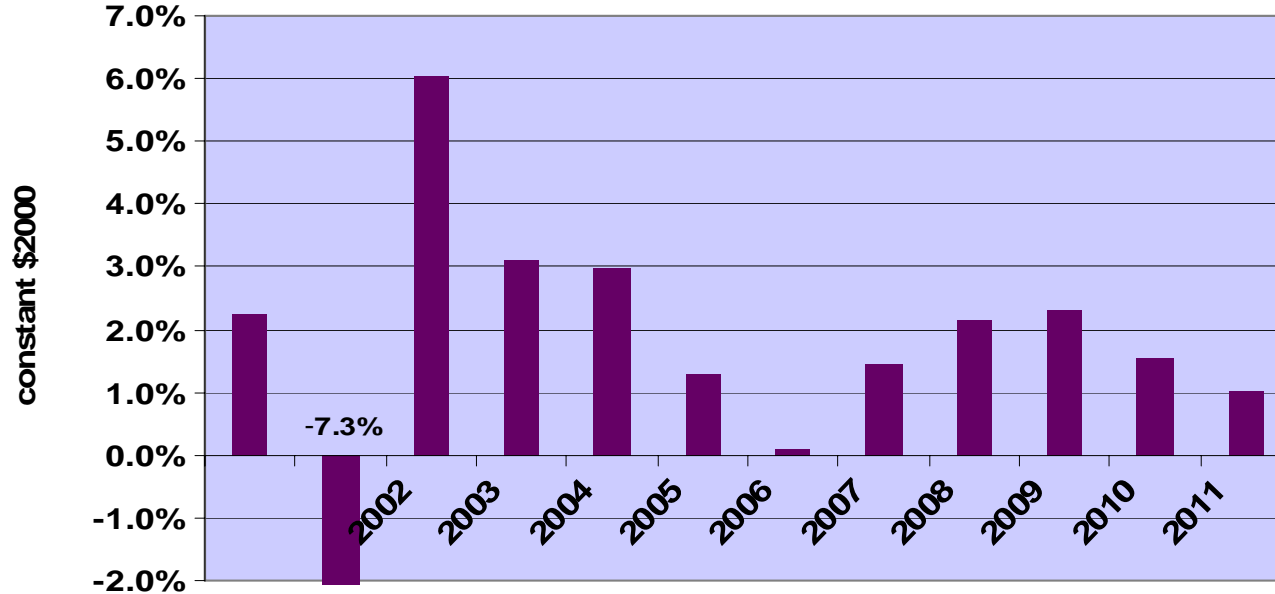
# Forecasting Demand for the Building Trades for the Midwest – An Example

# Building Trades Outlook: Midwest

- The Midwestern states show slight gains in the demand for some building trades, but they tend to follow the patterns of building activity, particularly those building types that are heavy users of specific occupations
- The strongest gains at the regional level are for operating engineers, reinforcing iron and rebar workers, and insulation workers.
- Losses are predicted for structural iron and steel workers, plasterers and stucco masons, and roofers.
- Over time, demands for specific trades can vary substantially as building activity responds to changing populations and preferences

# Projected Economic Growth is Modest

**Annual Growth in Real State Product  
(Midwestern States plus Kentucky)**



Sources: Economy.com & McGraw-Hill Construction

# Midwest States to Grow Slowly

## Average Annual Growth in State Product

	<u>2002-07</u>	<u>2007-11</u>
Illinois	3.4%	2.1%
Indiana	3.0%	2.1%
Ohio	1.2%	1.1%
Michigan	-1.8%	1.5%
Wisconsin	1.5%	1.8%

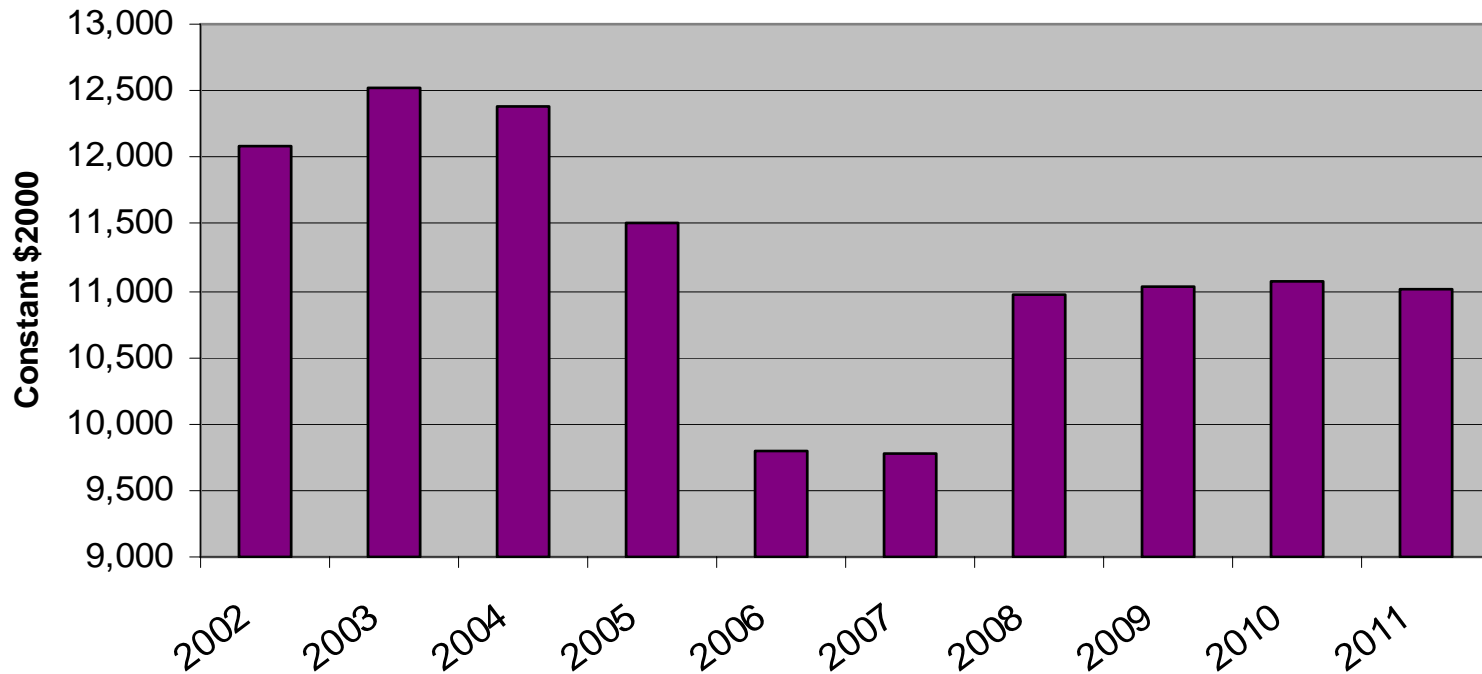
# Midwest States to Grow Slowly

## Average Annual Growth in State Product

	<u>2002-07</u>	<u>2007-11</u>
Iowa	4.1%	1.8%
Kansas	1.3%	2.0%
Minnesota	1.4%	1.9%
Missouri	4.6%	2.3%
Nebraska	2.8%	1.7%
North Dakota	4.8%	2.8%
South Dakota	0.5%	0.5%
Kentucky	2.2%	1.7%

# What Does This Mean for a Selected State?

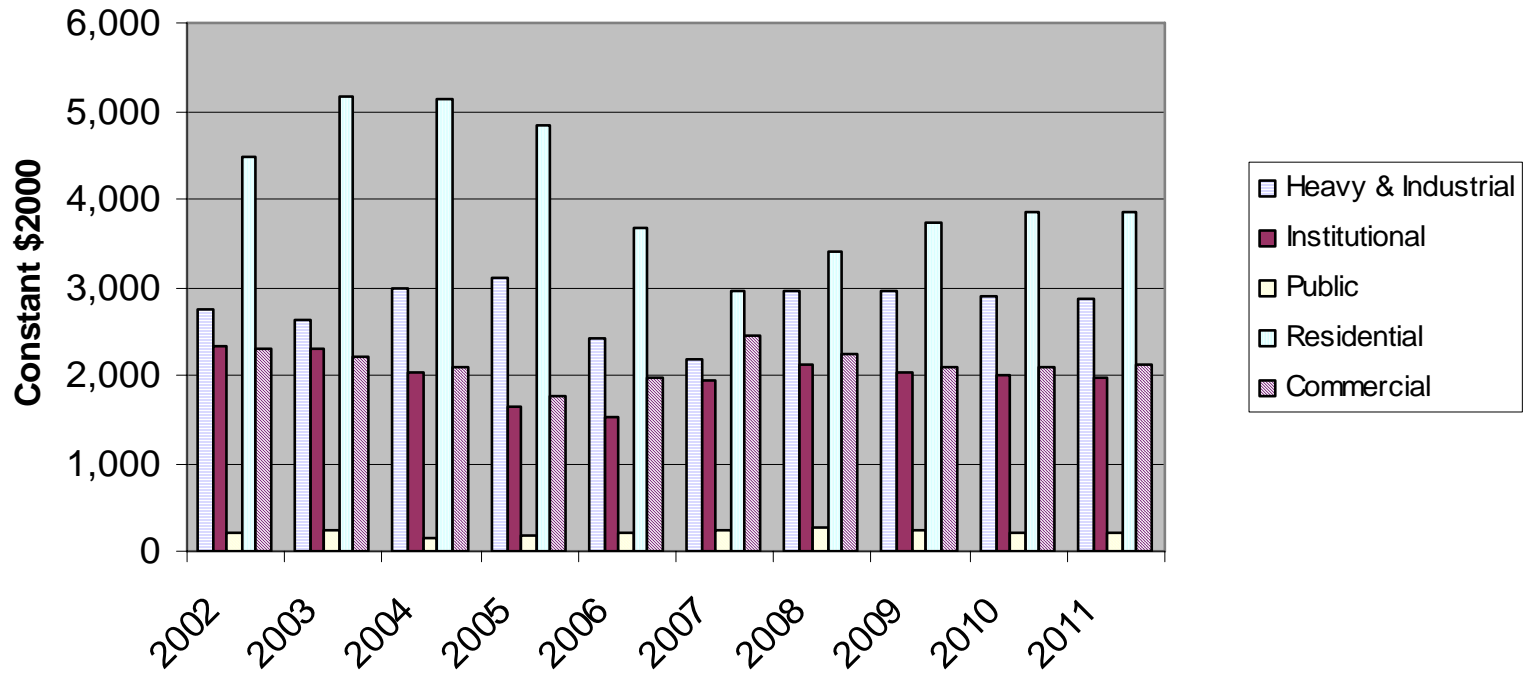
**Total Construction Spending: Minnesota  
(in millions of constant dollars)**



Source: McGraw-Hill Construction

# Variation by Building Type

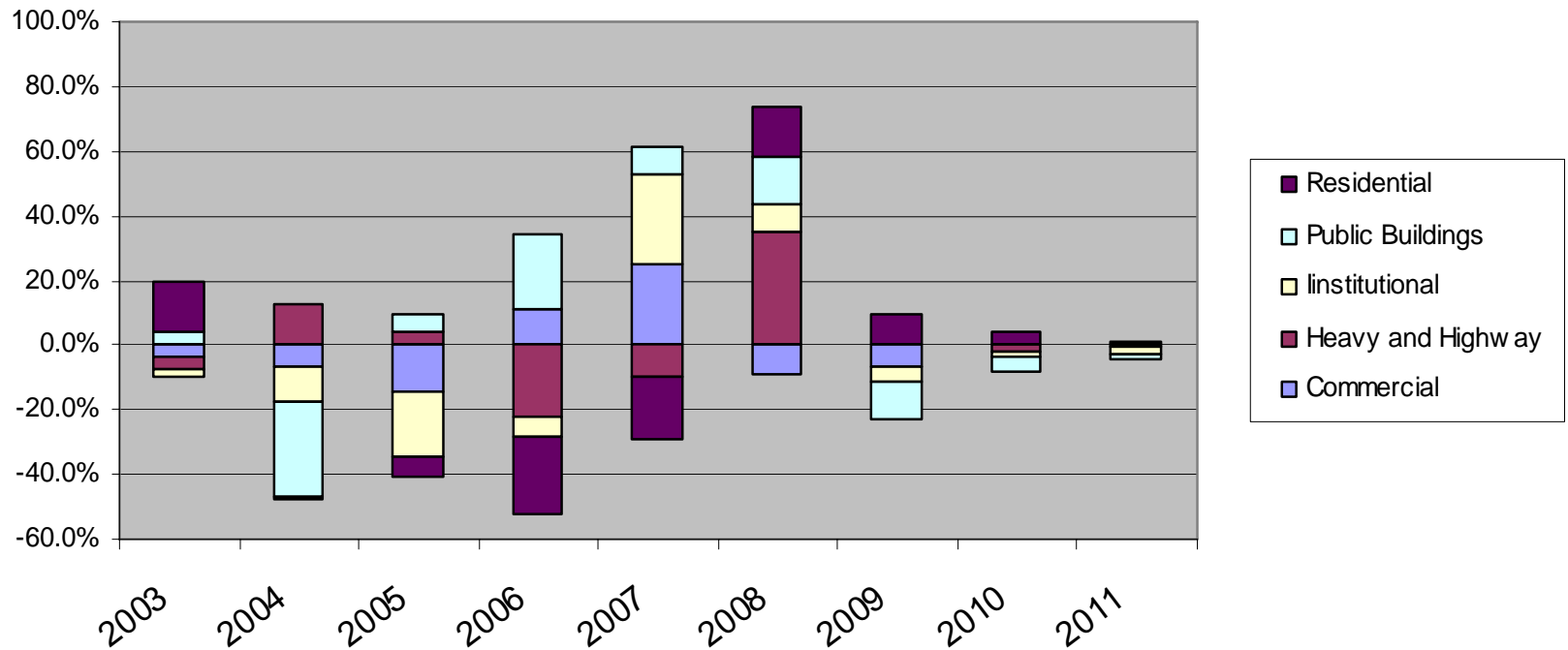
**Construction Spending by Project Type: Minnesota**  
(in millions of constant dollars)



Source: McGraw-Hill Construction

# Percentage Changes in Building Year-to-Year

Real Construction Spending -- Minnesota  
% Change



Source: McGraw-Hill Construction

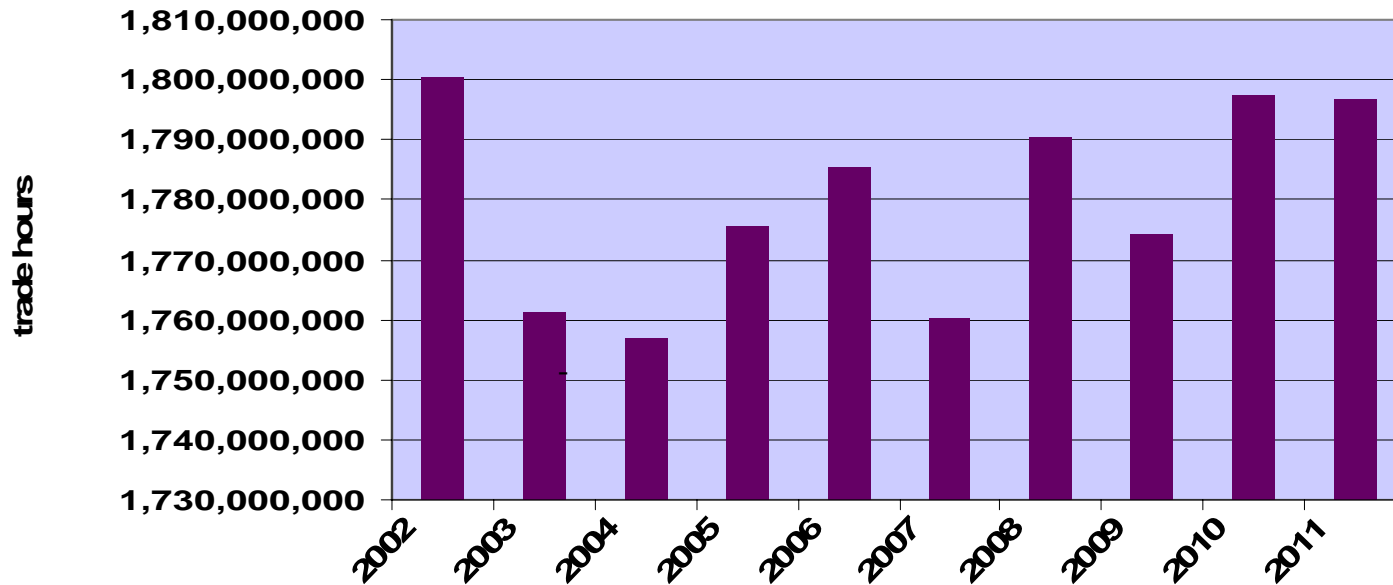
# Construction Activity in the East North Central Improves Marginally

	<u>2002-07</u>	<u>2007-11</u>
<b>Illinois</b>	<b>-0.2</b>	<b>-0.1</b>
<b>Indiana</b>	<b>-0.3</b>	<b>-0.3</b>
<b>Ohio</b>	<b>-3.7</b>	<b>1.6</b>
<b>Michigan</b>	<b>-5.9</b>	<b>2.4</b>
<b>Wisconsin</b>	<b>-3.8</b>	<b>0.6</b>

# Construction Activity in the West North Central Slips On Average

	<u>2002-07</u>	<u>2007-11</u>
Iowa	-1.5	-1.8
Kansas	-1.3	0.2
Minnesota	-4.1	2.4
Missouri	-1.0	-0.2
Nebraska	-0.1	-1.6
North Dakota	4.0	-2.1
South Dakota	2.0	-4.3
Kentucky	3.0	-1.3

# Total Trade Hours for the Midwest



Source: McGraw-Hill Construction

# Total Trade Hours for the Midwest

	<b>2002-06</b>	<b>2007-11</b>	<b>%ch</b>
<b>Boilermakers</b>	9,681,067	9,470,740	<b>-2.2%</b>
<b>Brickmasons and Blockmasons</b>	66,553,344	67,761,530	<b>1.8%</b>
<b>Cement Masons and Concrete Finishers</b>	93,646,259	99,088,673	<b>5.8%</b>
<b>Carpenters</b>	392,845,773	388,759,080	<b>-1.0%</b>
<b>Construction Laborers</b>	313,489,280	330,971,251	<b>5.6%</b>
<b>Electricians</b>	243,119,760	240,804,690	<b>-1.0%</b>
<b>Glaziers</b>	16,529,762	16,649,133	<b>0.7%</b>
<b>Insulation Workers</b>	22,741,726	24,366,579	<b>7.1%</b>
<b>Painters, Construction and Maintenance</b>	90,008,755	85,234,467	<b>-5.3%</b>

# Total Trade Hours for the Midwest and Kentucky: Selected Trades

	<b>2002-06</b>	<b>2007-11</b>	<b>%ch</b>
<b>Plumbers, Pipefitters, and Steamfitters</b>	188,905,434	187,028,831	<b>-1.0%</b>
<b>Elevator Installers and Repairers</b>	10,002,068	10,436,182	<b>4.3%</b>
<b>Operating Engineers</b>	126,003,821	136,370,237	<b>8.2%</b>
<b>Plasterers and Stucco Masons</b>	9,955,795	8,900,671	<b>-10.6%</b>
<b>Reinforcing Iron and Rebar Workers</b>	10,353,778	11,256,193	<b>8.7%</b>
<b>Roofers</b>	59,034,976	53,488,617	<b>-9.4%</b>
<b>Sheet Metal Workers</b>	69,751,136	64,462,132	<b>-7.6%</b>
<b>Structural Iron and Steel Workers</b>	35,860,864	31,966,312	<b>-10.9%</b>
<b>Tapers</b>	17,324,102	16,725,706	<b>-3.5%</b>

# Building Trades Details

- There is a lot to be gained from viewing regional and state forecasts for the building trades, but the devil is in the details
- Construction activity can shift substantially even when overall demands are stable
- It is crucial to be able to drill down to smaller geographic areas and ask what is really going on, both by examining local level forecasts and reviewing the queue of large projects moving towards start
- This capability is provided in McGraw-Hill Construction's Market Analyzer Program, a few of sample screens of which follow

# Market Analyzer Results

McGraw Hill  
CONSTRUCTION

## Market Analyzer

### Market/Product Analysis

**Main**

Market/Product Analysis

Customize Geographies

Define Project Types

Weight Construction (Demand)

Enter Sales Data

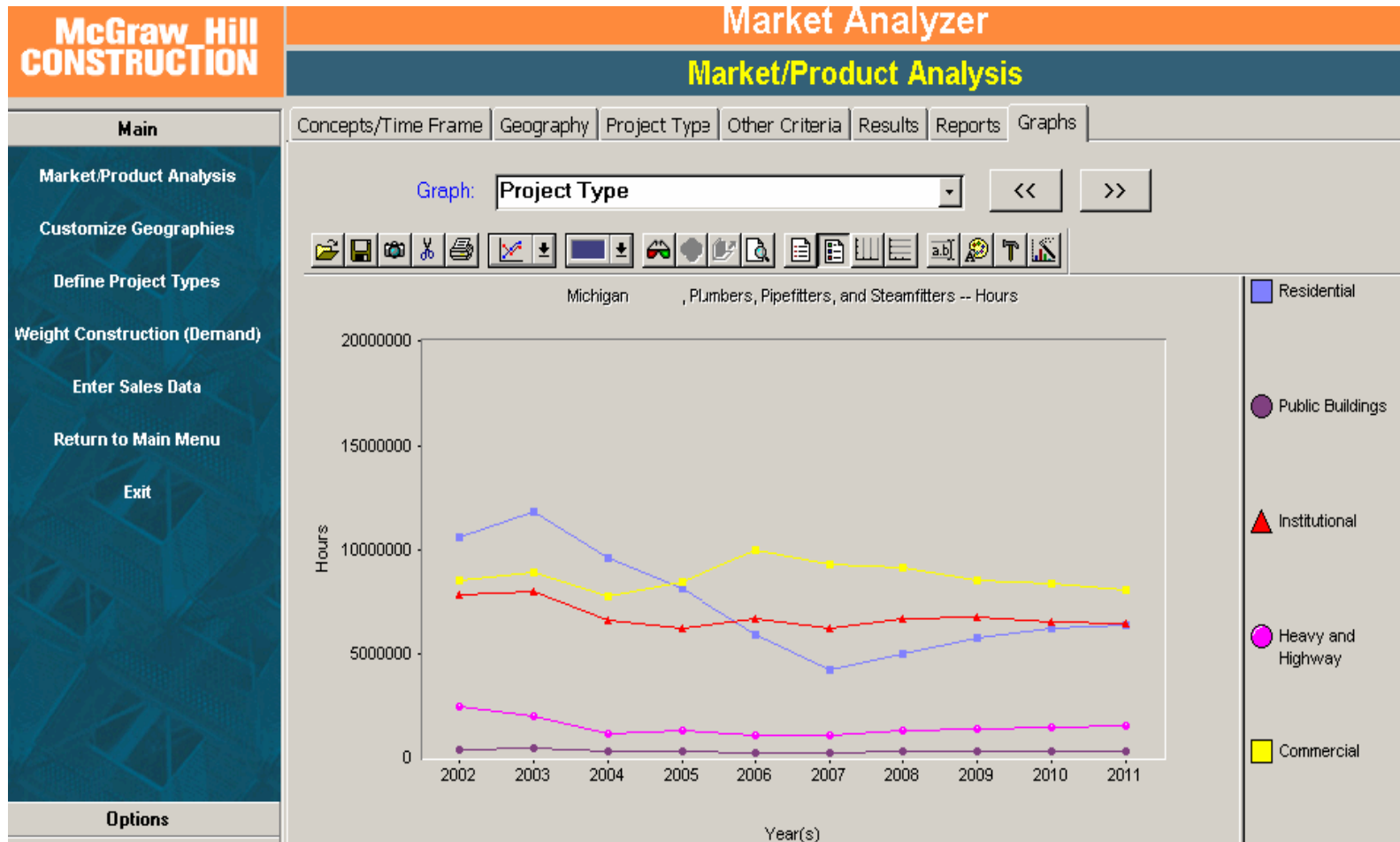
Return to Main Menu

Exit

Concepts/Time Frame
Geography
Project Type
Other Criteria
Results
Reports
Graphs

	State Name	Project Type	TRADE	Concept	2002	2003	2004
▶	Michigan	Commercial	Plumbers, Pipefitters, and Steamfitters	Hours	8,552,064	8,906,302	7,806,298
	Michigan	Institutional	Plumbers, Pipefitters, and Steamfitters	Hours	7,827,322	7,999,504	6,599,273
	Michigan	Public Buildings	Plumbers, Pipefitters, and Steamfitters	Hours	454,016	532,538	352,742
	Michigan	Residential	Plumbers, Pipefitters, and Steamfitters	Hours	10,635,204	11,870,323	9,634,376
	Michigan	Heavy and Highway	Plumbers, Pipefitters, and Steamfitters	Hours	2,498,785	2,006,149	1,191,310

# Marker Analyzer Results



# Final Notes

- The skilled trades demand methodology provides labor forecasts based on and consistent with McGraw-Hill Construction forecasts of building activity
- The results take account of local building practices and skilled trade shares
- The geographic and building type detail in MHC forecasts means projections of demand for the skilled construction trades extend down to the county level
- More work is needed to refine utilization rate, particularly at for finer geographies