Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #25 – 6.03 Actuarial Assumptions used for Projections

Does the application include:

- *a description of each of the assumptions used in the projections required under sections 3.01, 3.02, 4.02(1), 4.02(2), and 4.03 of Revenue Procedure 2017-43,*
- *supporting evidence for the selection of those assumptions, and*
- *an explanation of any differences among the assumptions used for various purposes?*

See section 6.03 of Revenue Procedure 2017-43.

Document 25.1 describes the assumptions used by the actuary for performing projections required under sections 3.01, 3.02, 4.02(1), 4.02(2), and 4.03 of Revenue Procedure 2017-43. The certification of critical and declining status described in 3.01 was prepared before this submission and includes assumptions that differ from those used to prepare other projections contained herein. These differences are noted.

Document 25.2 provides supporting documentation for the selection of certain assumptions including the actuary's rationale for the major assumptions.

Document 25.3 provides additional disclosures relating to the use of different assumptions.

Documents 25.1-25.3 are based on the actuary's interpretation of the requirements under Revenue Procedure 2017-43, Section 6.03 and Appendix B.

Carpenters Pension Trust Fund – Detroit and Vicinity
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Checklist Item #25 – 6.03 Actuarial Assumptions used for Projections

Document 25.1

Actuarial Assumptions and Methods Used for Projections

Investment Returns

- Dynamic Investment Targets

  The deterministic and stochastic investment return assumptions (other than those used for the certification of critical and declining status in checklist item #5) are impacted by the new Statement of Investment Policy Guidelines recently adopted by the Trustees. The guidelines contain 5 target portfolios (A through E). While target portfolio A is initially in effect, the investment targets will dynamically change to the other portfolios if and when a defined cash flow metric hits certain "trigger points." This metric is defined as the projected annual net cash flow (contributions less benefit payments and administrative expenses) as a percentage of the market value of fund assets at the beginning of the year. The following table summarizes the investment targets that would be in effect based on the value of the cash flow metric:

	Annual Projected FY Cash Flows as a Percentage of Beginning of FY Assets				
"Trigger"	> -7.5%	-7.5 to -12.5%	-12.5% to -17.5%	-17.5% to -22.5%	< -22.5%
Target Portfolio	**A**	**B**	**C**	**D**	**E**
US Equity					
Large Cap	21.0%	21.0%	21.0%	13.5%	8.0%
Small Cap	7.0%	7.0%	7.0%	5.0%	4.0%
International Equity					
Developed	7.2%	7.2%	7.2%	6.0%	3.0%
Emerging Markets	3.8%	3.8%	3.8%	0.5%	0.0%
Fixed Income					
US Core Fixed	15.0%	27.0%	39.0%	62.0%	85.0%
High Yield / Bank Loans	2.0%	2.0%	2.0%	2.0%	0.0%
EMD	2.0%	2.0%	2.0%	2.0%	0.0%
Alternatives					
Real Estate	20.0%	16.0%	12.0%	6.0%	0.0%
Hedge Funds	6.0%	6.0%	6.0%	3.0%	0.0%
Private Equity	8.0%	4.0%	0.0%	0.0%	0.0%
Private Debt	8.0%	4.0%	0.0%	0.0%	0.0%

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- Long/Short Term Expectations
  All investment return assumptions used in this application reflect the investment community's generally muted expectations for the first 10 years of the extended period ("short term") and more robust expectations for the remainder of such period ("long term").

- Deterministic Projections
  - For the certification of critical and declining status in checklist item #5:

Time Period	Term	Assumed Rate of Return
5/1/2020 – 4/30/2029	Short	6.50%
5/1/2029 –	Long	7.50%

  - For the current plan deterministic projections (i.e. without reflecting any MPRA suspension) in checklist item #6 (portfolio transitions assumed to occur based on the deterministically projected value of the cash flow metric):

Time Period	Term	Assumed Portfolio	Assumed Rate of Return
7/1/2020 – 4/30/2022	Short	A	6.50%[1]
5/1/2022 – 4/30/2025	Short	B	5.85%
5/1/2025 – 4/30/2027	Short	C	5.20%
5/1/2027 – 4/30/2028	Short	D	4.25%
5/1/2028 – 4/30/2030	Short	E	3.35%
5/1/2030 – 4/30/2033	Long	E	4.35%

  - For the proposed suspension and DNME deterministic projections in checklist items #6 and #11 (portfolio transitions assumed to occur based on the deterministically projected value of the cash flow metric with the proposed suspension):

Time Period	Term	Assumed Portfolio	Assumed Rate of Return
7/1/2020 – 4/30/2030	Short	A	6.50%[1]
5/1/2030 – 4/30/2033	Long	A	7.35%
5/1/2033 – 4/30/2046	Long	B	6.75%
5/1/2046 – 4/30/2052	Long	A	7.35%

[1] For the first 2 months of the 5/1/2020-4/30/2021 plan year, actual investment income was used. For the remaining 10 months of such plan year (the "initial period"), a return equal to 10/12ths of 6.50% was assumed.

- Stochastic Projections

  Stochastic projections were performed using 5,000 trials. For each year in each trial, correlated sample rates of return were produced by asset class and then blended according to the assumed investment percentages applicable to the particular year (portfolio transitions assumed to occur based on the deterministically projected value of the cash flow metric with the proposed suspension) according to the following table:

Time Period	Term	Assumed Portfolio
5/1/2021 – 4/30/2030	Short	A
5/1/2030 – 4/30/2033	Long	A
5/1/2033 – 4/30/2046	Long	B
5/1/2046 – 4/30/2052	Long	A

  Assets during the "initial period" ending April 30, 2021 were not varied stochastically.[1]

  The underlying asset class distributions were assumed to be log-normal with characteristics following the composite capital market assumptions shown in Exhibit 15 of *Survey of Capital Market Assumptions: 2020 Edition*, published by Horizon Actuarial Services, LLC.

  The arithmetic and geometric means, standard deviations, and correlations of applicable asset classes are shown below:

	Expected Returns				
	Short-Term		Long-Term		Standard Deviation
Asset Class	Arith	Geom	Arith	Geom	
US Large Cap	7.40%	6.16%	8.36%	7.06%	16.22%
US Small/Mid Cap	8.76%	6.85%	9.54%	7.56%	20.22%
Non-US Developed	8.33%	6.80%	9.09%	7.48%	18.05%
Non-US Emerging	10.59%	7.85%	11.33%	8.42%	24.23%
US Fixed - Core	2.75%	2.60%	3.74%	3.56%	5.47%
US Fixed - High Yield	5.36%	4.90%	6.14%	5.62%	9.75%
Non-US Fixed - Emerging	5.76%	5.16%	6.54%	5.85%	10.97%
Real Estate	7.15%	5.75%	7.91%	6.59%	16.84%
Hedge Funds	5.08%	4.74%	6.10%	5.71%	8.00%
Private Equity	11.42%	9.08%	12.54%	9.87%	21.99%
Private Debt	8.50%	7.75%	8.63%	7.85%	12.06%

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Correlation Matrix

	Asset Class	1	2	3	4	5	6	7	8	9	10	11
1	US Large Cap	1.00										
2	US Small/Mid Cap	0.89	1.00									
3	Non-US Developed	0.84	0.76	1.00								
4	Non-US Emerging	0.73	0.69	0.80	1.00							
5	US Fixed - Core	0.15	0.08	0.17	0.16	1.00						
6	US Fixed - High Yield	0.63	0.62	0.62	0.62	0.38	1.00					
7	Non-US Fixed - Emerging	0.48	0.44	0.52	0.62	0.44	0.62	1.00				
8	Real Estate	0.53	0.55	0.49	0.44	0.22	0.46	0.36	1.00			
9	Hedge Funds	0.63	0.61	0.63	0.61	0.15	0.53	0.43	0.37	1.00		
10	Private Equity	0.73	0.71	0.67	0.59	0.04	0.51	0.36	0.46	0.60	1.00	
11	Private Debt	0.57	0.57	0.53	0.52	0.11	0.73	0.40	0.39	0.52	0.56	1.00

Discount Rate for Calculating Present Values

For purposes of calculating the present values and funding ratios contained in this application (specifically in checklist items #5, 12, and 28), the following discount rate was used:

Discount Rate Used for Present Value Calculations:	**7.50%**

Mortality

- For purposes of the certification of critical and declining status in checklist item #5, Mortality was assumed to follow the RP-2006 blue collar mortality tables projected generationally using the MP 2018 projection scale. Sex-distinct mortality rates were used for males and females. The employee tables were used for all participants not in pay status while the healthy annuitant tables were used for all participants in pay status.

  No adjustments (such as set-forwards or rate multipliers) were applied.

- For all other projections,
  - Male mortality was assumed to follow 100% of the PRI-2012 blue collar male mortality tables projected generationally using the MP-2019 projection scale. The employee table was used for non-retired male participants and the healthy annuitant table was used for male participants in pay status.

  - Female mortality was assumed to follow 100% of the PRI-2012 blue collar female mortality tables projected generationally using the MP-2019 projection scale. The employee table was used for non-retired female participants and the contingent survivor table was used for female participants in pay status.

  Note that the PRI-2012 mortality study includes separate tables for annuitants and contingent survivors. DBVal provides for gender-distinct mortality tables, but does not allow a separate table to be used for contingent survivors. Since the majority of pay status males are primary annuitants, and since the majority of females are contingent

annuitants, the healthy annuitant table was used for all pay status males and the contingent survivor table was used for all pay status females.

Other Demographic Assumptions

- Withdrawal
  - For purposes of the certification of critical and declining status in checklist item #5 Ultimate rates of withdrawal are assumed to follow table T-7 (less GAM-51 mortality) from *The Actuary's Pension Handbook*. The complete table is shown below:

Age	Withdrawal Rate	Age	Withdrawal Rate	Age	Withdrawal Rate
20	0.099384	35	0.087062	50	0.042247
21	0.098898	36	0.085466	51	0.036823
22	0.098398	37	0.083717	52	0.031228
23	0.097877	38	0.081815	53	0.025661
24	0.097331	39	0.079756	54	0.020347
25	0.096742	40	0.077543	55	0.015488
26	0.096114	41	0.075151	56	0.011247
27	0.095438	42	0.072556	57	0.007718
28	0.094704	43	0.069760	58	0.004939
29	0.093906	44	0.066758	59	0.002879
30	0.093031	45	0.063540	60	0.001465
31	0.092065	46	0.060053	61	0.000594
32	0.091000	47	0.056227	62	0.000152
33	0.089820	48	0.052000	63+	-
34	0.088511	49	0.047337		

Additionally, special select rates are applied during the first 4 years that a participant is reported:

Year Reported	Select Withdrawal Rate
First	0.50
Second	0.30
Third	0.15
Fourth	0.15

- For all other projections, ultimate rates of withdrawal are assumed to follow table T-4 (less GAM-51 mortality) from *The Actuary's Pension Handbook*. The complete table is shown below:

Age	Withdrawal Rate	Age	Withdrawal Rate	Age	Withdrawal Rate
20	0.054384	35	0.046984	50	0.024773
21	0.054113	36	0.046058	51	0.021787
22	0.053838	37	0.045078	52	0.018623
23	0.053552	38	0.044052	53	0.015407
24	0.053246	39	0.042984	54	0.012285
25	0.052917	40	0.041878	55	0.009394
26	0.052555	41	0.040720	56	0.006847
27	0.052156	42	0.039496	57	0.004713
28	0.051712	43	0.038204	58	0.003024
29	0.051220	44	0.036834	59	0.001767
30	0.050672	45	0.035372	60	0.000901
31	0.050063	46	0.033768	61	0.000367
32	0.049393	47	0.031954	62	0.000094
33	0.048655	48	0.029873	63+	-
34	0.047853	49	0.027483		

Additionally, special select rates are applied during the first 4 years that a participant is reported:

Year Reported	Select Withdrawal Rate
First	0.50
Second	0.25
Third	0.10
Fourth	0.10

- Disability

  Rates of disability are assumed to follow 30% of the 1964 OASDI male table. The complete table is shown below:

Age	Disability Rate
20	0.000602
21	0.000656
22	0.000708
23	0.000758
24	0.000807
25	0.000854
26	0.000901
27	0.000948
28	0.000996
29	0.001046
30	0.001100
31	0.001159
32	0.001224
33	0.001297
34	0.001380

Age	Disability Rate
35	0.001474
36	0.001583
37	0.001707
38	0.001850
39	0.002014
40	0.002201
41	0.002415
42	0.002658
43	0.002933
44	0.003244
45	0.003595
46	0.003987
47	0.004426
48	0.004915
49	0.005458

Age	Disability Rate
50	0.006059
51	0.006723
52	0.007453
53	0.008254
54	0.009131
55	0.010089
56	0.011133
57	0.012267
58	0.013498
59	0.014830
60	0.016269
61	0.017820
62	0.019490
63	0.021285
64	0.023210
65+	-

- Retirement
  - For purposes of the certification of critical and declining status in checklist item #5, the following rates of retirement are assumed to apply for active participants:

Age	Retirement Rate: Without Index 80 or 85 Requirements	Retirement Rate: With Index 80 or 85 Requirements
55	0.10	0.25
56	0.10	0.25
57	0.10	0.25
58	0.10	0.25
59	0.15	0.25
60	0.15	0.25
61	0.30	0.25
62	0.30	0.40
63	0.30	0.40
64	0.05	0.40
65+	1.00	1.00

- For all other projections, the following rates of retirement are assumed to apply for active participants:

Age	Retirement Rate:	
	Without Index 80 or 85 Requirements	With Index 80 or 85 Requirements
55	0.10	0.50
56	0.10	0.25
57	0.10	0.25
58	0.10	0.30
59	0.10	0.35
60	0.10	0.25
61	0.25	0.25
62	0.30	0.40
63	0.15	0.15
64	0.15	0.15
65	0.20	0.20
66	0.30	0.50
67+	1.00	1.00

Assumptions Regarding Form and Commencement Age of Benefits

- "Take Up" Rate of Benefit Form Election
  - For purposes of the certification of critical and declining status in checklist item #5, future retirees were assumed to elect benefit forms according to the following table:

Benefit Form	Married Participants (65% Assumed)	Single Participants (35% Assumed)
Life annuity	15%	85%
Life-ten year certain	5%	15%
Joint & 50% survivor	20%	n/a
Joint & 75% survivor	15%	n/a
Joint & 100% survivor	45%	n/a

The effect of the various elections was approximated by using a hybrid form of benefit consisting of:

- Joint and 66.25% survivor for married actives
- 2-year certain for unmarried actives, and

- Joint and 43% survivor with 1 year certain for inactive vesteds.

The benefit amount was calculated using a blended conversion factor at each age that was the appropriately-weighted average of the actual conversion factors at that age.

- For purposes other than the certification of critical and declining status in checklist item #5, future retirees were assumed to elect benefit forms according to the following table:

Benefit Form	Married Participants (65% Assumed)	Single Participants (35% Assumed)
Life annuity	18%	85%
Life-ten year certain	3%	15%
Joint & 50% survivor	24%	n/a
Joint & 75% survivor	12%	n/a
Joint & 100% survivor	43%	n/a

The various elections were explicitly valued. This was done by performing multiple runs and taking an appropriately-weighted average of the projected benefit payments and other values.

- Survivor Percentage

  If a participant is receiving, or assumed to receive, a joint and 50% survivor or joint and 75% survivor annuity, the actual surviving spouse payment expressed as a percentage of the participant's benefit (the "effective survivor percentage") may be greater than the stated survivor percentage in a post-suspension or DNME ("does not materially exceed") run. This situation arises when a surviving spouse is affected by the PBGC guarantee limitation to a greater extent than the participant. Note that this situation does not arise in the context of a joint and 100% survivor benefit as the survivor's payment is equal to the participant's payment.

  While we were able to value this effect explicitly for individuals in pay status, the valuation software would not allow us to do so for active and inactive vested participants. Therefore, we assumed the following average effective survivor percentages:

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Participant Group:	Effective Survivor Percentage Assumed for:			
	Suspension Projections Checklist #6		DNME Projections Checklist #11	
	Joint and 50% Survivor	Joint and 75% Survivor	Joint and 50% Survivor	Joint and 75% Survivor
Active	51.071%	75.232%	51.045%	75.226%
Inactive Vested	57.184%	78.179%	56.926%	78.068%

These assumptions were developed by calculating the effective survivor percentage for each individual at a commencement age of 59 (or current age if older) and averaging the results.

- Spouse Assumptions
  In the case of non-pay status participants, married couples were assumed to be opposite sex with the male spouse 2 years older than the female.

- Loading for pop-up feature
  - For purposes of the certification of critical and declining status in checklist item #5, liabilities for non-retired participants' benefit to be paid after retirement were increased 0.6% to account for the pop-up feature. Pop-up amounts for retirees receiving a joint and survivor form of benefit were explicitly valued.

  - For all purposes other than the certification of critical and declining status in checklist item #5, liabilities for non-retired participants' benefits to be paid after retirement were increased 0.9% to account for the pop-up feature. Pop-up amounts for retirees receiving a joint and survivor form of benefit were explicitly valued.

- Benefit Commencement Age for Withdrawal Benefits
  - For purposes of the certification of critical and declining status in checklist item #5, current inactive vested participants are assumed to retire at age 59 if they have at least 10 years of service, or age 62 if less than 10 years of service. Future inactive vested participants are assumed to retire at age 59.

  - For all purposes other than the certification of critical and declining status in checklist item #5, current inactive vested participants are assumed to retire according to the following decrement table:

Age	Inactive Retirement Rate	
	<10 Years of Service	10+ Years of Service
55	-	0.12
56	-	0.06
57	-	0.06
58	-	0.06
59	-	0.06
60	-	0.06
61	-	0.10
62	0.03	0.25
63	0.03	0.15
64	0.15	0.20
65	0.35	0.40
66	0.10	0.35
67	0.10	0.20
68	0.05	0.20
69	0.05	0.15
70+	1.00	1.00

Future inactive vested participants (i.e., withdrawal benefit for participants who are currently active) are assumed to commence at age 59.

- Benefit Commencement Age for Disability Benefits
  Current and future disabled participants are assumed to convert to retirement benefits at age 62.

Assumptions Regarding Missing or Incomplete Data

- Assumption Regarding Terminated Vested Participants Beyond Normal Retirement Age
  All known inactive vested participants were assumed to be alive. The fund office recently undertook a data clean-up project that resulted in the acquisition of hundreds of addresses for such people who were previously "missing."

  It was assumed that inactive vested participants who are past their IRC section 401(a)(9) required beginning date ("RBD") on May 1, 2020 will be put into pay status retroactive to such date.

- Unrecorded Date of Birth Assumptions
  The age of participants with unrecorded dates of birth was estimated based on the average entry age of participants with recorded dates of birth and the same vesting status. To derive these averages, we looked at the entire active and inactive vested

population with reported dates of birth in the 2019 valuation data. The breakdown of average entry age of those participants is as follow:

Data Utilized for Entry Age Assumption		
Vesting Status	**Active and Inactive Vested Participants With DOB**	**Average Entry Age**
Vested	10,062	27
Non-Vested	1,814	32

In the data utilized for the projections, there were 71 missing dates of birth. 69 were non-vested active participants who were assumed to have been 32 years old at their date of hire, and 2 were inactive vested participants who were assumed to have been 27 years old at their date of hire.

Unrecorded Dates of Birth	
Status	**Count**
Active - Non-Vested	69
Inactive Vested	2

New Entrant Profile

- Distribution of assumed future new entrants by age and sex are as follows:

Age	Sex	Distribution
20	M	20.48%
25	M	20.26%
30	M	21.45%
35	M	13.40%
40	M	9.06%
45	M	5.92%
50	M	4.55%
55	M	4.87%

- Future new entrants were assumed to work 1,269 hours per year, adjusted to align with each year's assumed total hours worked by the Plan.

Contribution Rates

- A $14.85 per hour average contribution rate was assumed for projecting contributions to the plan.

- Individual assumed future contribution rates were set equal to the individual participant's average hourly rate received during the 2018-2019 plan year and then pro-rated so that the total group average was $14.85 per hour. It was assumed that 39% of this rate would be credited (i.e., benefit bearing).

Contribution Base Units

- The following future hours worked were assumed for purposes of projecting contributions to the plan:

Plan Year Ending 4/30:	Hours
2021	6.9 million
2022	7.0 million
2023	7.0 million
2024+	6.9 million

- Individual active participants were assumed to work 1,600 hours per year if they were vested and 600 hours per year otherwise. However, these numbers were pro-rated in order to conform the total hours worked by the entire population to the table above.

Withdrawal Liability Payments

- For purposes of the certification of critical and declining status in checklist item #5, no future withdrawal liability payments were assumed.

- For all other purposes, the following future withdrawal liability payments were assumed:

Plan Year(s) Ending 4/30:	Assumed EWL Payments From:		
	Prior Withdrawals	Future Withdrawals	Total
2021	$ 1,333,196	$ -	$ 1,333,196
2022-2023	36,159	963,841	1,000,000
2024	36,159	763,841	800,000
2025-2033	36,159	613,841	650,000
2034	12,056	637,944	650,000
2035-2037	7,236	642,764	650,000
2038	3,618	646,382	650,000
2039+	-	650,000	650,000

The assumed payment for the plan year ending April 30, 2021 includes a large assessment that is currently being litigated. It was assumed that the fund would receive a lump sum payment equal to the assessed liability with a one-third probability.

Administrative Expenses

- For purposes of the certification of critical and declining status in checklist item #5, non-investment expenses were assumed to be $4,090,000 for the plan year ending 2020 and assumed to increase at the rate of 2.25% per year thereafter.

- For all other purposes, non-investment expenses were assumed to be $6,106,627 for the plan year ending April 30, 2021. Expenses for the plan year ending April 30, 2022 were assumed to be $4,688,160. Expenses for the plan year ending April 30, 2023 were assumed to be $4,288,676 and were assumed to increase at the rate of 2.4% per year thereafter.

Investment Liquidation Expenses

It was assumed that the Fund would have liquidation expenses of $5 million (reflecting early termination fees and realized losses) upon the initial transition from portfolio A to portfolio B. Note that this assumption does not apply to the certification of critical and declining status in checklist item #5.

Projection Methodology

- The DBVal valuation system was used to perform all actuarial calculations. Future asset values for deterministic and stochastic projections were calculated in Excel. Correlated samples for stochastic projections were generated using the R language.

- As discussed above, for purposes of the certification of critical and declining status in checklist item #5, the effect of the "take-up" rate of optional benefit form elections was approximated by using a hybrid form and amount of benefit.

- No data grouping techniques were used.

- The following changes to the cash flow projections were incorporated:

    - Inactive vested participants were processed in separate runs in order to properly value the desired retirement decrements. No pre-retirement withdrawal or disability rates were assumed for these runs.

    - For each plan design scenario, 5 active-only runs (one for each form of benefit), 5 inactive vested-only runs (one for each form of benefit), and one pay status run were done. The projected benefit payments from these 11 runs were blended, along with projected benefits from assumed new entrants, to produce the final stream of benefit payments.

- Benefit payments from the valuation system output are given as of the beginning of each plan year. These were multiplied by a one-half year interest adjustment factor to produce cash flows.

- For purposes of the certification of critical and declining status in checklist item #5, active participant cash flows from the valuation system were adjusted for contribution rate and total hours. For all other purposes, these adjustments were handled within the system.

Document 25.2

Supporting Documentation for Selection of Certain Assumptions

Investment Returns

- Dynamic Investment Targets

  The deterministic and stochastic investment return assumptions (other than those used for the certification of critical and declining status in checklist item #5) are impacted by the new Statement of Investment Policy Guidelines recently adopted by the Trustees. The guidelines contain 5 target portfolios (A through E). While target portfolio A is initially in effect, the investment targets will dynamically change to the other portfolios if and when a defined cash flow metric hits certain "trigger points." This metric is defined as the projected annual net cash flow (contributions less benefit payments and administrative expenses) as a percentage of the market value of fund assets at the beginning of the year. The following table summarizes the investment targets that would be in effect based on the value of the cash flow metric:

	Annual Projected FY Cash Flows as a Percentage of Beginning of FY Assets				
"Trigger"	> -7.5%	-7.5 to -12.5%	-12.5% to -17.5%	-17.5% to -22.5%	< -22.5%
Target Portfolio	**A**	**B**	**C**	**D**	**E**
US Equity					
Large Cap	17.0%	17.0%	17.0%	11.0%	8.0%
Small Cap	7.0%	7.0%	7.0%	5.0%	4.0%
International Equity					
Developed	4.0%	4.0%	4.0%	4.0%	3.0%
Emerging Markets	3.0%	3.0%	3.0%	0.0%	0.0%
Small Cap					
Global Equity					
Global Equity	8.0%	8.0%	8.0%	5.0%	0.0%
Fixed Income					
US Core Fixed	15.0%	27.0%	39.0%	62.0%	85.0%
High Yield / Bank Loans	2.0%	2.0%	2.0%	2.0%	0.0%
EMD	2.0%	2.0%	2.0%	2.0%	0.0%
Balanced					
Balanced Fund	0.0%	0.0%	0.0%	0.0%	0.0%
Alternatives					

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	Annual Projected FY Cash Flows as a Percentage of Beginning of FY Assets				
"Trigger"	> -7.5%	-7.5 to -12.5%	-12.5% to -17.5%	-17.5% to -22.5%	< -22.5%
Target Portfolio	**A**	**B**	**C**	**D**	**E**
Real Estate	20.0%	16.0%	12.0%	6.0%	0.0%
Hedge Funds	6.0%	6.0%	6.0%	3.0%	0.0%
PE / PD	16.0%	8.0%	0.0%	0.0%	0.0%

- In order to make use of data from the *Survey of Capital Market Assumptions: 2020 Edition*, published by Horizon Actuarial Services, LLC (Survey), we had to translate the asset classes used in the Trustees' investment policy guidelines to those used in the Survey. With input from the Fund's Investment Consultant, the following investment targets were developed:

	Annual Projected FY Cash Flows as a Percentage of Beginning of FY Assets				
"Trigger"	> -7.5%	-7.5 to -12.5%	-12.5% to -17.5%	-17.5% to -22.5%	< -22.5%
Target Portfolio	**A**	**B**	**C**	**D**	**E**
US Large Cap	21.0%	21.0%	21.0%	13.5%	8.0%
US Small/Mid Cap	7.0%	7.0%	7.0%	5.0%	4.0%
International Equity Developed	7.2%	7.2%	7.2%	6.0%	3.0%
International Equity Emerging	3.8%	3.8%	3.8%	0.5%	0.0%
US Fixed – Core	15.0%	27.0%	39.0%	62.0%	85.0%
US Fixed – High Yield	2.0%	2.0%	2.0%	2.0%	0.0%
International Fixed - Emerging	2.0%	2.0%	2.0%	2.0%	0.0%
Real Estate	20.0%	16.0%	12.0%	6.0%	0.0%
Hedge Funds	6.0%	6.0%	6.0%	3.0%	0.0%
Private Equity	8.0%	4.0%	0.0%	0.0%	0.0%
Private Debt	8.0%	4.0%	0.0%	0.0%	0.0%

The following asset classes used in the investment guidelines were not explicitly included in the Study and were therefore allocated among other included classes in the preceding table:

- Global Equity was assumed to be comprised of 50% US Large Cap, 40% Non-US Equity Developed, and 10% Non-US Equity Emerging

- Private Equity and Debt ("PE / PD") was assumed to be comprised of 50% Private Equity and 50% Private Debt

- Net Investment Return Assumptions Used for Deterministic Projections
  - Short- and long-term net investment return assumptions for deterministic projections were developed for each possible target investment portfolio (A-E) based on the median returns derived from 10,000 short (10-year) and long (20-year) term portfolio simulations. The return distribution characteristics for each portfolio were derived from the expected net returns, standard deviations, and correlations from the *Survey of Capital Market Assumptions: 2020 Edition* (Survey).

  - A summary of the median return from the simulations we conducted and the final selected return assumption for each target portfolio (both short- and long-term) is shown below. Note that not every return from the following table is used in this application.

Portfolio	Trigger	Term	Median Return	Assumed ROR
A	> -7.5%	Short	6.47%	6.50%
A	> -7.5%	Long	7.35%	7.35%
B	-7.5% to -12.5%	Short	5.85%	5.85%
B	-7.5% to -12.5%	Long	6.76%	6.75%
C	-12.5% to -17.5%	Short	5.20%	5.20%
C	-12.5% to -17.5%	Long	6.15%	6.15%
D	-17.5% to -22.5%	Short	4.26%	4.25%
D	-17.5% to -22.5%	Long	5.22%	5.20%
E	<-22.5%	Short	3.36%	3.35%
E	<-22.5%	Long	4.35%	4.35%

  - Since the capital market returns provided in response to the Survey included the effects of inflation and were net of investment-related expenses, we did not employ an explicit inflation or investment expense assumption.

  - The assumed $5 million loss upon initial transition from Portfolio A to Portfolio B was based on advice provided by the Investment Consultant.

Assumed Dates for Portfolio Transitions

Our basic deterministic model recognizing the proposed suspension saw the initial transition from Portfolio A to Portfolio B occurring May 1, 2033. Under this scenario, projected benefit payments reach a maximum level during the 2036-2037 plan year and monotonically decrease after that. The rate of decrease in plan assets continually slows leading up to the low point of April 30, 2047, after which plan assets increase. The decrease in benefit payments combined

with the projected turnaround in assets causes the cash flow metric to improve during the 2040-2041 plan year. The metric passes the -7.5% mark for the 2046-2047 plan year and the investments are assumed to return to Portfolio A.

These same portfolio transition dates (May 1, 2033 to Portfolio B and May 1, 2046 back to Portfolio A) were used for our basic stochastic modeling work recognizing the proposed suspension.

Demographic Experience

- Experience Studies

  UAS does not typically perform formal experience studies for our clients. We typically assess the appropriateness of assumptions by looking at 5-year histories of demographic experience (expected versus actual exits by cause) and aggregate liability gain or loss relative to the size of accrued liability. If an assumption looks questionable, we perform an internal demographic experience study.

  A 10-year history of demographic experience is provided below. Note that the expected exits and deaths shown in the following tables are based on the assumptions that were used for the actuarial valuation report prepared as of the beginning of each period, not necessarily on the assumptions used to prepare this application.

PYE 4/30:	Expected and Actual Exits From Active Status Due To:					
	Retirement		Disablement		(Net) Withdrawal	
	Expected	Actual	Expected	Actual	Expected	Actual
2019	107.6	82	7.3	9	950.3	879
2018	96.9	97	6.8	6	792.8	403
2017	78.1	80	22.1	5	824.3	653
2016	73.5	96	21.6	8	702.9	506
2015	77.4	46	30.2	5	646.4	500
2014	78.8	53	30.5	12	368.4	669
2013	102.7	57	32.1	48	407.0	684
2012	104.0	117	31.5	47	373.8	272
2011	77.7	123	30.7	41	372.8	220
2010	141.0	173	37.9	61	488.6	1,466

PYE 4/30:	Expected and Actual Deaths by Status					
	Actives		Inactive Vesteds		Retirees	
	Expected	Actual	Expected	Actual	Expected	Actual
2019	10.1	9	43.7	37	273.2	299
2018	8.9	12	40.1	30	269.1	298
2017	9.8	15	32.9	36	301.3	289
2016	9.3	13	30.6	26	298.3	304
2015	9.2	7	23.6	50	324.1	287
2014	9.5	6	22.2	25	318.1	280
2013	10.2	13	21.3	26	314.1	295
2012	10.6	8	21.6	22	264.2	295
2011	10.4	12	23.5	55	256.2	258
2010	12.9	16	20.4	53	250.6	292

- Select period withdrawal assumptions

  Select period withdrawal assumptions for projections for all purposes other than the certification of critical and declining status in checklist item #5 were based upon an updated experience study of withdrawals for the 5 year period ending April 30, 2019. The following table summarizes the experience evaluated. Note that rehires were netted out of withdrawals.

Year	Exposure	Net Withdrawals	Rate
1	3,738	1,865	49.89%
2	1,556	414	26.61%
3	1,026	116	11.31%
4	747	75	10.04%

- Pop-up load assumption

  The pop-up load for all purposes other than the certification of critical and declining status in checklist item #5 was re-evaluated with this filing in conjunction the change in mortality assumption. The demographic data was based upon the May 1, 2019 actuarial valuation.

  The derivation appears below:

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Basic Input Items	
Spouse/Retiree Assumed Age Difference	2
Assumed Retirement Age	60
Average Attained Age of Actives	42
Average J&S Percentage Elected	80.34%
Percentage of Retirees Electing J&S	56.10%
Actuarial Equivalent Interest	6.50%
Valuation Interest	7.50%
Is Pop-up Subsidized?	Yes
Normal Form Certain Period	0

Mortality Assumptions	**Participant**	**Spouse**
Actuarial Equivalent Mortality	UP84	UP84
Set Forward	0	0
Valuation Mortality	PRI 2012	PRI 2012
Projection Scale	MP 2019	MP 2019
Set Forward	0	0
% of mortality table	100%	100%

Conversion Factor Used by Plan - SL to 80.34% J&S - Ages 60/58		
1. SL PV factor - participant	10.1919	
2. SL PV factor - spouse	10.6278	
3. JL PV factor - first to die	8.5841	
4. Final conversion factor	0.8613	=(1)/[(1)*100% + [(2)-(3)]*80.34%]

Load Calculation - ACTIVES/DEFERRED VESTEDS		
1. SL PV factor - participant	10.8557	
2. SL PV factor - spouse	11.0884	
3. JL PV factor - first to die	9.6297	
4. PV factor - with pop-up	12.2251	=(3)*100% + [(1)-(3)]/0.8613 + [(2)-(3)]*80.34%
5. PV factor - no pop-up	12.0276	=(1)*100% + [(2)-(3)]*80.34%
6. Final load	**0.9%**	=[(4)/(5) - 1]*56.10%

- Liability Gain/Loss Analysis
  Liability gains/losses as reported in each actuarial valuation report for the last 10 years, both as a dollar amount and as a percentage of accrued liability, are shown below:

PYE 4/30:	Liability (Gain)/Loss	
	As $ Amount	As % of Liability
2019	$ 11,072,484	0.49%
2018	12,008,517	0.54%
2017	17,488,095	0.81%
2016	14,607,648	0.69%
2015	(2,276,720)	-0.11%
2014	16,203,453	0.78%
2013	11,546,638	0.55%
2012	16,834,372	0.81%
2011	41,566,901	2.07%
2010	(23,845,603)	-1.17%

- Percentage of Plan Population That Is Married
  For the 5 plan years ending April 30, 2019, 1,147 people commenced retirement benefits. Of these, 770, or 67.1%, were married and, on average, the male spouse was 2.07 years older than the female spouse. There were no same sex married couples reported.

- Distribution of Optional Form Elections
  The distribution of optional form elections at retirement for the plan years ending April 30, 2015-2019 is shown below:

Benefit Form	Married Participants Electing	Single Participants Electing
Life annuity	17.8%	84.1%
Life-ten year certain	3.0%	13.8%
Joint & 50% survivor	23.8%	0.5%[2]
Joint & 75% survivor	12.5%	1.1%[2]
Joint & 100% survivor	43.0%	0.5%[2]

- Rates of Retirement by Age
  Retirement experience for actives during the 5 plan years ending April 30, 2019 is summarized below:

[2] The plan does not allow single participants to elect a joint and survivor form of benefit. The apparent instances of this in the table above are due to divorced retirees who elect a joint and survivor annuity pursuant to the terms of a qualified domestic relations order (QDRO). For the purpose of selecting the "take up percentage" assumption, these percentages were assumed to be zero.

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	Without Index 80 or 85			With Index 80 or 85		
Age	Exposure	Retirements	Rate	Exposure	Retirements	Rate
55	495	49	9.9%	164	46	28.0%
56	387	26	6.7%	72	19	26.4%
57	314	18	5.7%	44	11	25.0%
58	274	27	9.9%	41	12	29.3%
59	213	20	9.4%	39	14	35.9%
60	157	13	8.3%	32	8	25.0%
61	114	27	23.7%	27	7	25.9%
62	110	36	32.7%	12	5	41.7%
63	56	8	14.3%	6	1	16.7%
64	35	6	17.1%	7	1	14.3%
65	17	3	17.6%	5	2	40.0%
66	21	4	19.0%	6	1	16.7%
67	7	2	28.6%	4	2	50%
68	5	-	0.0%	3	2	66.7%
69	3	-	0.0%	-	-	-
70	4	-	0.0%	-	-	-
>70	3	-	0.0%	-	-	-

Retirement experience for inactive vested participants during the 5 plan years ending April 30, 2019 is summarized below:

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Age	10+ Years of Service			3-9 Years of Service		
	Exposure	Retirements	Rate	Exposure	Retirements	Rate
55	441	53	12.0%	-	-	-
56	377	25	6.6%	-	-	-
57	347	16	4.6%	-	-	-
58	294	16	5.4%	-	-	-
59	287	16	5.6%	-	-	-
60	249	16	6.4%	-	-	-
61	221	23	10.4%	-	-	-
62	192	43	22.4%	526	2	0.4%
63	141	19	13.5%	472	0	0.0%
64	112	23	20.5%	410	66	16.1%
65	93	38	40.9%	282	109	38.7%
66	52	19	36.5%	153	15	9.8%
67	29	5	17.2%	116	12	10.3%
68	22	4	18.2%	84	5	6.0%
69	20	3	15.0%	61	3	4.9%
70	12	4	33.3%	34	7	20.6%
>70	14	2	14.3%	56	6	10.7%

Mortality Assumptions

- Experience Study Underlying Mortality Rates

  We selected the PRI-2012 mortality tables as the mortality basis for this application. These tables can be found in the *PRI-2012 Mortality Tables Report* issued by the Society of Actuaries (https://www.soa.org/resources/experience-studies/2019/pri-2012-private-mortality-tables/).

  We feel this family of tables is the most appropriate for the purpose of the measurements contained herein because (1) they are based on a very large dataset (16.1 million life years), (2) they are current (all data came from calendar years 2010-2014), and (3) the dataset upon which they are based includes a substantial amount of multiemployer data (approximately 70% of the blue collar data came from multiemployer plans).

  The vast majority of participants in the plan are employed in the construction industry as a carpenter or in a related trade (e.g., millwright). As such, they would classified as blue collar workers. Therefore, we used the blue collar tables.

  Finally, as is typically appropriate for pension plans, we used the benefit weighted tables in preparing this application.

Note that the PRI-2012 mortality study includes separate tables for annuitants and contingent survivors. DBVal provides for gender-distinct mortality tables, but does not allow a separate table to be used for contingent survivors. Since the majority of pay status males are primary annuitants, and since the majority of females are contingent annuitants, the healthy annuitant table was used for all pay status males and the contingent survivor table was used for all pay status females.

- Process Used to Construct Tables
  As we have selected the blue collar tables of the *PRI-2012 Mortality Tables Report* issued by the Society of Actuaries as the basis for the mortality assumptions, we refer the reader to the text of this study for a detailed description of how the tables were constructed (see link above).

- Mortality Adjustments
  We performed a credibility-weighted mortality adjustment study based on plan deaths of participants over the age of 50 during the most recent 5 plan years for which data was available (plan years ending April 30, 2015-2019) using the methodology outlined in Regulation 1.430(h)(3)-2. Our study used the formulas appropriate for a benefit-weighted mortality table.

  The results of our study were as follows:

	Males	Females
Adjustment if 100% Credible	99.9%	97.7%
Credibility Factor	0.749	0.445
Credibility-weighted Adjustment	99.9%	99.0%

  After considering these results, we decided to use the unadjusted tables from the study

- Mortality Improvement
  We used the Society of Actuaries' MP-2019 improvement scales to project mortality rates generationally, which we believe to be appropriate for the purpose.

New Entrant Profile

- The distribution of ages of new entrants over the past 5 years appears below:

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Age Range	Percentage of New Entrants for PYE 4/30:				
	2019	2018	2017	2016	2015
≤20	20.22%	20.05%	20.77%	22.19%	19.16%
23-27	20.49%	19.92%	20.97%	19.19%	21.02%
28-32	22.65%	18.63%	21.36%	20.05%	25.93%
33-37	12.82%	15.30%	12.07%	14.05%	11.89%
38-42	8.39%	9.79%	9.69%	9.60%	7.47%
43-47	4.96%	6.59%	6.13%	6.08%	5.60%
48-52	5.69%	4.35%	4.95%	3.94%	3.93%
53+	4.78%	5.37%	4.06%	4.88%	5.01%

New entrants studied included inactive participants returning to the workforce.

Contribution Base Units and Employer Withdrawals

- Employers That Contributed Over 5%
  Information on the employers that made more than 5% of total plan year contributions during the last 10 plan years for which data is available (plan years ending April 30, 2010-2019) appears below. Note that, during 5 of the last 10 plan years, no single employer accounted for more than 5% of the total contributions. Therefore, there is no entry for these plan years (plan years ending April 30, 2019, 2018, 2017, 2016, and 2010).

PYE 4/30:	Employer Name	Percent of Total	Hours	Average Contribution Rate	Total Contribution
2015	Employer A	8.10%	520,846	$ 16.30	$ 8,488,041
2014	Employer B	6.17%	315,567	19.10	6,028,496
2014	Employer A	5.56%	330,062	16.44	5,427,692
2014	Employer C	5.43%	313,658	16.90	5,301,144
2013	Employer B	7.94%	564,592	12.60	7,112,439
2013	Employer C	6.51%	319,310	18.26	5,830,619
2012	Employer B	9.14%	657,240	11.99	7,882,031
2012	Employer C	5.78%	388,064	12.84	4,983,881
2011	Employer C	7.86%	649,819	8.20	5,328,570
2011	Employer B	6.14%	342,167	12.18	4,167,883

The largest percentage contributed by a single employer in those years where no employer accounted for 5% or more of the total contribution base is shown in the following table.

PYE 4/30:	Largest Percentage Contributed by a Single Employer
2019	3.76%
2018	3.66%
2017	4.19%
2016	4.20%
2010	4.89%

- Historical Trends – Contribution Base Units (Hours)

  As recently as the early 2000's, the plan had annual contribution hours in excess of 14 million. However, by 2010, hours had hit a low point of 5.8 million. The decline was largely driven by a struggling Detroit economy. Please see table of historic of work hours below:

PYE 4/30:	Work Hours
2020	7,212,686
2019	7,795,753
2018	8,332,526
2017	7,478,853
2016	7,446,260
2015	6,965,968
2014	6,386,096
2013	6,689,107
2012	7,131,329
2011	6,572,509

PYE 4/30:	Work Hours
2010	5,796,364
2009	8,454,305
2008	10,500,468
2007	10,020,514
2006	11,118,510
2005	11,830,720
2004	12,130,239
2003	13,131,324
2002	14,156,290
2001	14,551,472

The auto industry touches the lives of most of Detroit's residents in one way or another. Consequently, when the auto industry goes through a tough time, so does Detroit. By the late 2000's, flagging car sales had forced both Chrysler and GM to file for bankruptcy. The decline of these great American companies, on top of the "great recession" being felt across the country, had a chilling effect on union construction projects, resulting in the sharp decline in hours.

Work hours rebounded to some extent since 2010, exceeding 8 million in 2018 (the only year in the past decade where this occurred). However, changes in state labor laws, a

decline in union market share, a dramatically scaled back Auto Show, other project-specific issues and, of course the COVID-19 pandemic, have and will continue to force a short-term decline in hours.

The Trustees expect hours for the plan year ended April 30, 2021 to be further depressed by the pandemic to 6.9 million. They predict a slight increase for 2022 and 2023 based on the theory that some projects put on hold because of the pandemic will restart following the general availability of a vaccine, but ultimately think hours will average around 6.9 million. We agree with this assessment and have set our future work hours assumption accordingly.

- Historical Trends – Contribution Rates

  Beginning in 2006, the bargaining parties began making consistent contribution rate increases in an attempt to improve the plan's funding situation. These increases were typically non-credited/non-benefit bearing. During the period 2006-2014, the average hourly contribution rate increased from about $4 to over $15, and the percentage credited dropped from 100% to about 39%. Please see Document 26.1.

  On August 1, 2013, the Trustees voted to adopt the "all reasonable measures" option under the Pension Protection Act. Since that time there have been no negotiated increases (though the average does fluctuate from year to year based on the changing distribution of work among the various collective bargaining agreements).

  The Trustees and bargaining parties feel that the high contribution rate coupled with the low effective accrual rate make it difficult to attract and retain the best workers. Furthermore, the high contribution rates make it difficult for contractors to compete in the bidding process. Therefore, the sponsors are of the opinion that future contribution rate increases would be detrimental to the plan and that negotiated increases are highly unlikely in the foreseeable future. Given this, we feel that a flat contribution rate assumption (i.e. assuming no future increases) is reasonable and appropriate.

  We based our future average hourly contribution rate assumption on the weighted average contribution rate received over the 7 plan years during which the "all reasonable measures" option was in effect (since there have been no negotiated contribution rate increases in that time). Please see the following development:

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PYE 4/30:	Hours	Audited Contributions	EWL Payments	Contributions Excluding EWL Payments	Average Contribution Rate
2014	6,386,096	$ 97,871,522	$ -	$ 97,871,522	$ 15.33
2015	6,965,968	106,709,394	1,180,886	105,528,508	15.15
2016	7,446,260	111,258,164	-	111,258,164	14.94
2017	7,478,853	106,706,279	-	106,706,279	14.27
2018	8,332,526	123,147,221	7,236	123,139,985	14.78
2019	7,795,753	116,595,346	3,100,521	113,494,825	14.56
2020	7,212,686	109,088,249	52,500	109,035,749	15.12
TOTAL	**51,618,142**	**$ 771,376,175**	**$ 4,341,143**	**$ 767,035,032**	**n/a**

Dividing the 7-year total contributions excluding EWL payments by the 7-year total hours, yields a weighted average contribution rate of $14.86 per hour. We selected our assumed future contribution rate of $14.85 per hour by rounding this weighted average to the nearest $0.05.

The sources of information for the preceding table are as follows:

- Hours History based on information in the most recent historical data file provided by the administrator.
- Contributions based on audited contributions, except for the PYB 2019 is based on unaudited financial statements, as the April 30, 2020 financial audit is not yet completed.
- EWL Payments provided by Fund Counsel.
- Average contribution rate calculated from other columns.

- Experience with Withdrawal Liability Collections
  The plan's 10-year experience with withdrawal liability collections has been as follows:

PYE 4/30:	Withdrawal Liability Collected
2011	$ 55,520
2012	1,355,000
2013	540,000
2014	-
2015	1,180,886
2016	-
2017	-
2018	7,236
2019	3,061,736
2020	52,500

Because of the small number of withdrawals that are actually assessable due to the construction industry exemption, there is quite a bit of volatility in the collection numbers.

Two employers are currently making quarterly payments, and a case against a third employer is being litigated. Based on the known payment schedules and assuming a one-third probability that the case in litigation will result in payment of the allocated liability, we estimated collections for the current plan year at $1,333,196.

We felt that, as hours are projected to decline, there would be a greater chance of withdrawal liability assessments. Therefore, we left assumed collections at the $1 million level for 2021 through 2023. After that we assumed $800,000 for 2024 as a transition down the 10-year average of about $650,000, which we assumed for all plan years thereafter.

Our 2019 withdrawal liability report shows 13 contractors who paid some withdrawal liability. Of those, 5 were paid in full and 8 were settled or written off. The "discount" on the settlements fell in the range of 15%-40%. The write-offs were negotiated with due diligence based on the facts and circumstances of each case and resulted in settlement amounts that were deemed actually collectible, although less than the assessed amounts.

Take-up Rate With Respect to Selection of Benefit/Contribution Schedules

The initial rehabilitation plan adopted in 2008 had only 2 schedules: the "preferred" and the "default." Following the adoption of this plan, every bargaining unit adopted the preferred schedule.

In the 2012 update to the rehabilitation plan, the preferred schedule called for contribution rate increases every year through 2016 on the Commercial, Display, Floorlayer, Millwright, and

Roadbuilder contracts. However, when the "all reasonable measures" plan was adopted the following year, rates were essentially frozen at the 2013 level and have not been increased since.

Projection Methodology

- Approximation Techniques
  As previously discussed, for purposes of the certification of critical and declining status in checklist item #5 the effect of the "take-up" rate of optional benefit form elections was approximated by using a hybrid form and amount of benefit.

- Cash Flow Projections
  - Inactive vested participants were processed in separate runs in order to properly value the desired retirement decrements. This was done because our valuation system does not fully support inactive decrements.

  - For each plan design scenario, 5 active-only runs (one for each form of benefit), 5 inactive vested-only runs (one for each form of benefit), and one pay status run were done. The projected benefit payments from these 11 runs were blended, along with projected benefits from assumed new entrants, to produce the final stream of benefit payments. This was done because our valuation system does not allow the user to assume multiple forms of benefit payment in a single run.

  - Benefit payments from the valuation system output are given as of the beginning of each plan year. These were multiplied by a one-half year interest adjustment factor to produce cash flows. We think it is more intuitive to work with cash flows rather than interest-adjusted cash flows. Additionally, all benefit payments produced by the valuation system are discounted at the valuation interest rate, whereas, when projecting assets, various rates of interest are applied.

  - For purposes of the certification of critical and declining status in checklist item #5, active participant cash flows from the valuation system were adjusted for contribution rate and total hours.

Document 25.3

Additional Disclosures Relating to the Use of Different Assumptions

- Deterministic Projections
  Explanation of differences between assumptions used under sections 4.02(1) and 3.01 of Revenue Procedure 2017-43.

  - The long-term (10+ years) interest rate used for the Critical and Declining certification under section 3.01 is a flat 7.5%, whereas, the deterministic projections under section 4.02(1) are based on 7.35% with a 13-year period (5/1/2033-4/30/2046) where 6.75% is assumed. The 7.35% long-term rate used in this application was selected based on the 2020 edition of Horizon's *Survey of Capital Market Assumptions*, while the 7.5% used in the certification matched the 2019 actuarial valuation report, which constituted the basis of such certification.

    The 13-year period of lower (6.75%) returns reflects assumed dynamic portfolio target changes pursuant to the new investment policy guidelines, which were not in effect when the certification under section 3.01 was prepared.

    Similarly, the assumed $5 million investment loss upon initial transition from portfolio A to portfolio B was not applicable when the certification was prepared.

  - The "take-up" rate for benefit form election was approximated with a hybrid form of benefit under section 3.01, whereas, the assumption is explicitly valued under section 4.02(1). When the certification of critical and declining status was completed, it was based on the 2019 actuarial valuation report, which used the hybrid form approach. Explicit valuation of the "take-up" rate for benefit form election would not have changed the critical and declining status.

  - For purposes of section 3.01, current inactive vested participants are assumed to retire at age 59 if they have at least 10 years of service, or age 62 if less than 10 years of service. Under the section 4.02(1) calculations, retirement rates are used to value inactive vested participants. The critical and declining certification did not explicitly value multiple retirement ages for inactives. This additional coding would not have changed the critical and declining status.

  - For the projections under section 3.01, no future withdrawal liability payments were assumed. At the time the critical and declining certification was prepared, we did not think it would be material to the results of the certification.

- For the projections under section 3.01, we did not take into account any increased expenses due to the MPRA filing or future inflation in expenses. We followed our standard valuation practice of assuming flat expenses going forward when completing the certification. When completing this application, we decided it would be more accurate to account for increased expenses due to the MPRA filing as well as include a future inflation adjustment in our expense assumption.

- Stochastic Projections
  Other than differences inherent in deterministic versus stochastic modeling, we do not believe there are any material discrepancies between the assumptions used for the deterministic projection under section 4.02(1) of Revenue Procedure 2017-43, and the stochastic projections under section 4.02(2).

- Present Value Discount Rate
  For purposes of calculating the present values and funding ratios contained in this application (specifically in checklist items #5, 12, and 28), a 7.5% discount rate was used. This is the discount rate used in preparing the May 1, 2019 Actuarial Valuation Report. Solvency projections included herein utilize different interest rate assumptions as described above.

- Reconciliation of Datasets
  The certification of critical and declining status in checklist item #5 was based on the May 1, 2019 Actuarial Valuation Report. However, an updated May 1, 2019 dataset was utilized for all other projections contained in this application. A reconciliation of participant count differences in the two datasets appears below.

	Participant Counts		
	Active	**Inactive Vested**	**Receiving Benefits**
5/1/2019 Valuation Dataset	5,694	6,444	7,466
Updated 5/1/2019 Dataset for Application	5,682	6,413	7,357
Change	**(12)**	**(31)**	**(109)**

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #25 – 6.03 Actuarial Assumptions used for Projections

Reconciliation of Change in Active Count	**Effect on Participant Count**
• Confirmed not a participant of the fund	-1
• Confirmed deceased before valuation date with no eligible beneficiary	-1
• Awarded disability retroactive before valuation date	-1
• Duplicate records found	-9
Net Change	**-12**

Reconciliation of Change in Inactive Vested Count	**Effect on Participant Count**
• Confirmed deceased before valuation date with no eligible beneficiary	-6
• Duplicate records found	-1
• Deferred beneficiaries due a benefit that is not expected to be payable during the extended period (lump sum death benefit >$5,000)	-24
• Deferred beneficiary who entered pay status before valuation date	-1
• Deferred beneficiary determined to have no benefit payable	-1
• Alternate payees now valued as deferred beneficiaries (in addition to the current spouse records already valued)	2
Net Change	**-31**

Reconciliation of Change in Pay Status Count	**Effect on Participant Count**
• Confirmed deceased before valuation date with no eligible beneficiary	-1
• Alternate Payees receiving shared interest payment now combined with participant's record	-139
• Alternate Payees in pay status now valued separately; for valuation purposes, the liability attributable to these people was assumed to be included in the participant's liability because the participant is still active	28
• Beneficiaries found to have commenced benefits prior to valuation date	2
• Awarded disability retroactive before valuation date	1
Net Change	**-109**

Carpenters Pension Trust Fund – Detroit and Vicinity

20-year Forecast

August 26, 2019

Prepared by

Malcolm S. Cohen, PhD
President, Employment Research Corporation

Prepared for

Michigan Regional Council of Carpenters, Carpenters Pension Trust Fund – Detroit & Vicinity
c/o Benesys, Inc.
Attn: Joan Janks, Plan Manager
700 Tower Drive, Ste. 300
Troy, MI 48098

Carpenters Pension Trust Fund – Detroit and Vicinity – 20-year Forecast

I was asked to make a 20-year projection of hours worked for unionized carpenters in the state of Michigan. This report summarizes my findings.

Qualifications– Malcolm S. Cohen, PhD

I am the president of Employment Research Corporation, a firm located in Ann Arbor, Michigan, that specializes in employment and wage and hour research. I obtained my Ph.D. in Economics from MIT, with specializations in Econometrics and Labor Economics. After graduating from MIT, I worked for the U.S. Bureau of Labor Statistics in Washington, D.C. I have taught at the University of Maryland, the University of Michigan, and the University of Minnesota. The classes I have taught include Statistics, Economics, Labor Market Information, Human Resource Management, Human Resource Information Systems, and Econometrics. I served as Director of the Institute of Labor and Industrial Relations at the University of Michigan from 1980 to 1993. At the University of Michigan, I also served varied terms as the Chairman of the Program for Human Resource Development, a graduate certificate program, between 1975 and 1978. I have conducted extensive research on labor market issues, new hires, labor shortages and labor market information. I have written over 50 articles and books on related topics. I have testified or been a consultant in over 1,000 audits or cases and have testified over 300 times. I have also served as an expert to the EEOC and U.S. Department of Labor.

Under contract to the Wage and Hour Division of the U.S. Department of Labor, I prepared detailed estimates of the number and characteristics of the exempt and non-exempt employees for congressionally mandated minimum wage studies published in June 1998 and January 2001. Additionally, under contract to the Wage and Hour Division, I prepared a report describing major changes in the U.S. economy and estimating how those changes would impact the viability of 29 CFR § 541 regulatory requirements (namely, The “New Economy" and Its Impact on Executive, Administrative and Professional Exemptions to the Fair Labor Standards Act (FLSA)). The DOL submitted each of these reports to the U.S. Congress for its information and use in considering proposed regulations and legislation. My Curriculum Vitae is attached as Appendix A.

Related Publications

While I was at the Institute of Labor and Industrial Relations at the University of Michigan from 1972-1993, I authored or coauthored a number of related publications, including:

"The Economic Outlook for the Metropolitan Areas of Michigan" with George A. Fulton and Donald R. Grimes. *The Economic Outlook for 1987, proceedings of the Thirty-fourth Annual Conference on the Economic Outlook*. Ann Arbor: Research Seminar in Quantitative Economics, University of Michigan

Occupational Employment Forecasts for the Flint SMSA, with Arthur R. Schwartz and Donald R. Grimes.

Civilian Labor Force, Employment and Unemployment Forecasts, Michigan, East and Central Major Areas, with Harold T. Shapiro, Arthur R. Schwartz, and Alan Kett.

Civilian Labor Force, Employment and Unemployment Forecasts, Southeast Michigan, with Harold T. Shapiro, George A. Fulton, and Arthur R. Schwartz.

Civilian Labor Force, Employment and Unemployment Forecasts, Michigan, Western Major Areas, with Harold T. Shapiro, Arthur R. Schwartz, and Alan Kett.

Civilian Labor Force, Employment and Unemployment Forecasts, State of Michigan, with Harold T. Shapiro and George A. Fulton.

Civilian Labor Force, Employment and Unemployment Forecasts: Multi-County Balance of State Areas, with Harold T. Shapiro, Arthur R. Schwartz, Alan Kett, and Philip Mirowski.

Wage and Salary Forecast, Michigan, with Arthur R. Schwartz.

Civilian Labor Force, Employment and Unemployment Forecasts for the Flint SMSA.

An Econometric Model of a Local Urban Labor Market: The Flint SMSA.

An Econometric Model of a Local Urban Labor Market: The Denver, Colorado SMSA.

Data and documents reviewed

In preparing this report I have reviewed the following data and publications:

1. Michigan Regional Council of Carpenters Pension Trust Fund Detroit and Vicinity Summary Plan Description, January 1, 2017.
2. First-seventh and thirteenth Amendments to the Pension Plan of the Carpenters' Pension Trust Fund – Detroit and Vicinity (As Restated on October 7, 2014).
3. Carpenters Pension Trust Fund All Reasonable Measures Plan 2013.
4. 10-Year Active Membership Statistics, UBC Midwestern District 2009-2019.
5. Annual Carpenters Pension Trust Fund Actuarial Valuation Reports May 1, 2011 – May 1, 2018.
6. Wage rates for various union locals for time periods from 2016 to 2018 for different areas in Michigan.
7. Various collective bargaining agreements for the Michigan Regional Council of Carpenters.
8. Financial Statements for the Carpenters' Pension Trust Fund – 2012-2017.
9. Form 990 and Form 5500 for tax years ending 4/30/2013-4/30/2017.
10. An email from Paul Newcomer dated April 26, 2019 providing background for the report.
11. Data from the U.S. Department of Labor, Bureau of Labor Statistics, Occupational Employment Survey on the Employment of Carpenters, 2003-2018.
12. U.S. Bureau of Labor Statistics, Occupational Outlook Handbook, 5/22/2019.
13. University of Michigan RSQE press release Job Growth Michigan Forecast 2017-2020.
14. National employment projections, U.S. Department of Labor Bureau of Labor Statistics, Employment Projections, 2016-2026, and descriptions of their methodology.
15. Michigan Occupational Employment Projections, Michigan Bureau of Labor Market Information and Strategic Initiatives, 2016-2026.

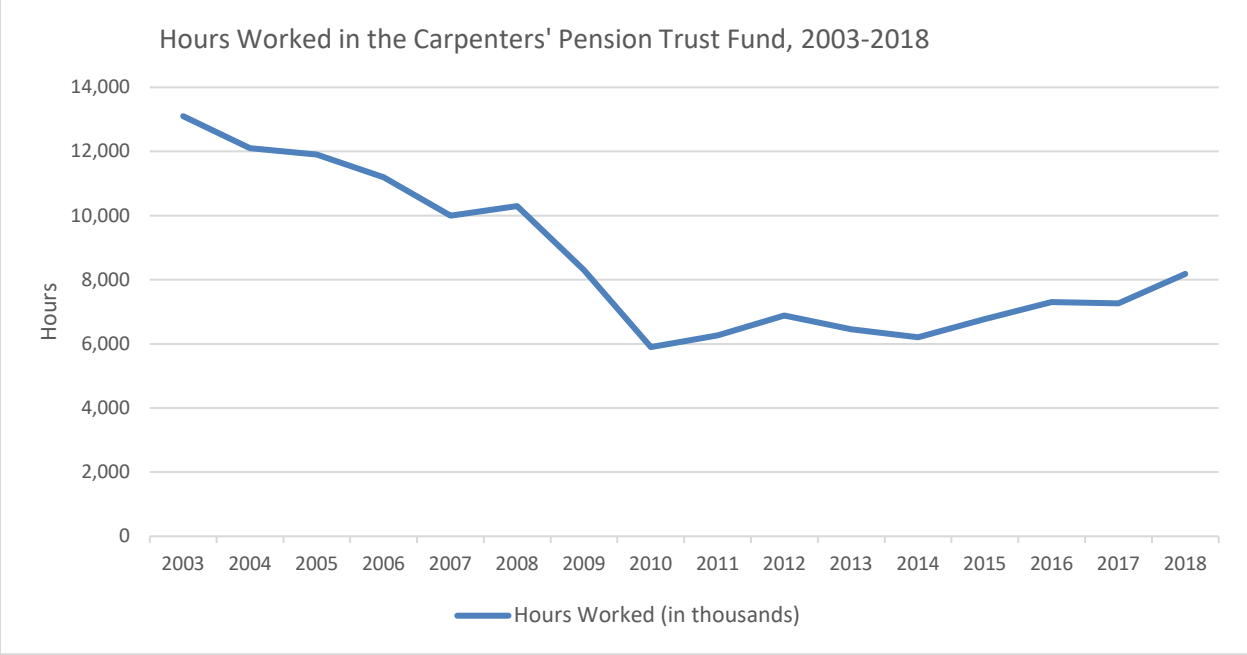
16. Labor Force Statistics Derived from the CPS, September 1982, BLS Bulletin 2096.
17. Bureau of Labor Statistics, Employment and Earnings, January 1983.
18. Current Population Survey, Employed Persons by detailed Occupation, 1983-2002.
19. Current Population Survey, Employed Persons by detailed Occupation and Sex, annual averages, 2000-2010.
20. Current Population Survey, Employed Persons by detailed Occupation and Sex, annual averages, 2011-2018.
21. Trends in carpenter employment (number of jobs reported by establishment) in Detroit, Michigan and the United States, 1997 -2018.
22. https://finance.yahoo.com/news/jeffrey-gundlach-increases-us-recession-odds-75-percent-193520909.html.
23. National Bureau of Economic Research, US Business Cycle Expansions and Contractions.
24. https://www.cnbc.com/2019/08/22/manufacturing-sector-contracts-for-the-first-time-in-nearly-a-decade-according-to-ihs-markit.html

Analysis

I was asked to make a projection of demand for unionized construction-industry carpenters in Michigan. I was provided with historical data on hours worked by members of the Carpenters Pension Trust Fund – Detroit and Vicinity ("the Fund"). Employer contributions to the Fund are related to each employee's hourly rate. There are different kinds of projections. Economists look at past trends and current leading indicators and make projections based on these trends. These forecasts are intended to assist analysts in understanding broad trends and risks and are not intended to determine actual contribution rates that should be made to keep a pension plan solvent. These determinations are typically made by actuaries that have more experience with fund flows and understand risks to the solvency of the fund. They also have a better understanding of the specifics of the fund contributors as well as specific risks.

The Fund's Annual Actuarial Valuation reports hours worked each year. Figure 1 shows hours worked for the Fund between 2003 and 2018.[1]

Figure 1



Source: Annual Carpenters Pension Trust Fund Actuarial Valuation Reports May 1, 2011 – May 1, 2018

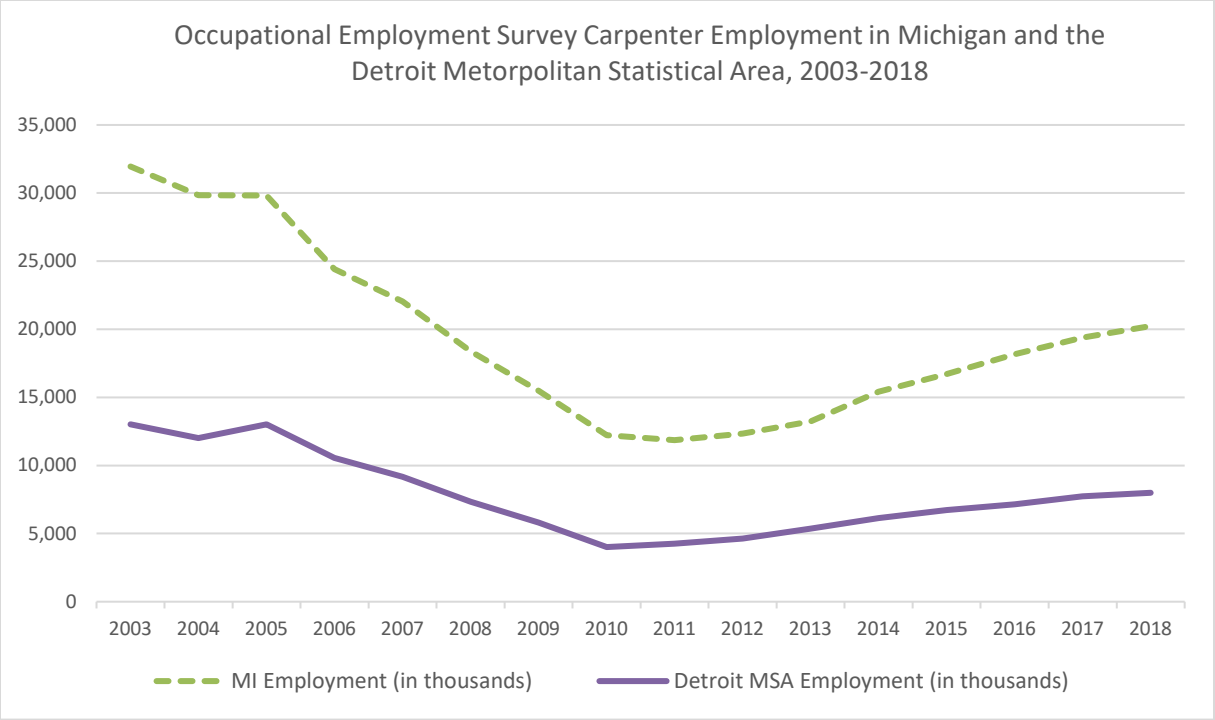
From 2003 to 2010, hours worked by Carpenters in the Fund declined. From 2010 to 2018, hours worked increased from just under 6 million hours per year to nearly 8 million hours per year, or 4.2% per year. This high rate of growth was related to the recovery from the 2008-2010 recession and is unlikely to continue.

In order to project expected hours worked for future years, I compared the data on hours with measures related to industry activity such as Carpenters' employment in the United States, Michigan and the Detroit Metropolitan Statistical Area. Figure 2 shows Carpenter employment in Michigan and in the Detroit Metropolitan Statistical Area from 2003 to 2018.[2]

Figure 2

[1] I was provided with actuarial valuations for 2011-2018. The 2012 valuation included a chart I used to estimate hours worked back to 2003.

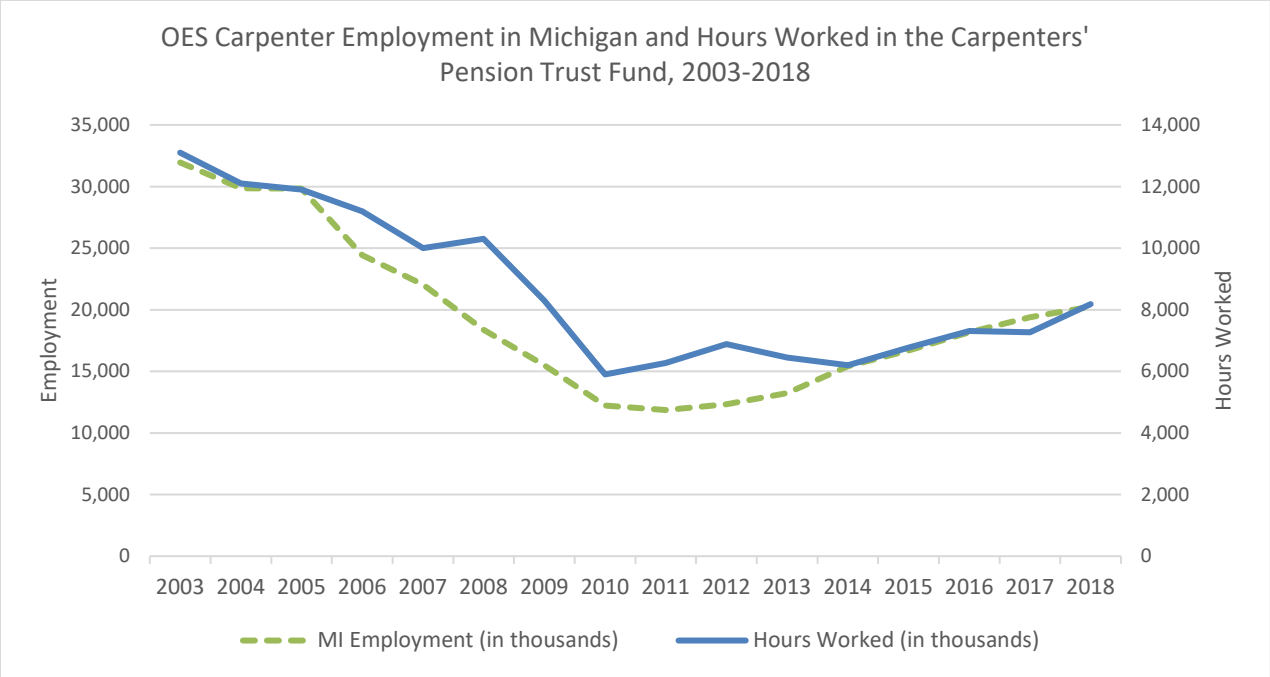
[2] Occupational Employment Statistics Data for Michigan and the Detroit Metropolitan Statistical area for Carpenters (47-2031), 2003-2018, U.S. Bureau of Labor Statistics.



Source: Bureau of Labor Statistics, Occupational Employment Survey, 2003-2018.

Both Michigan employment and the Detroit Metropolitan Area employment exhibit a similar historical pattern as hours worked by members of the Carpenters Pension Trust Fund. Figure 3 shows both Carpenter employment in Michigan and hours worked in the Carpenters Pension Trust Fund.

Figure 3

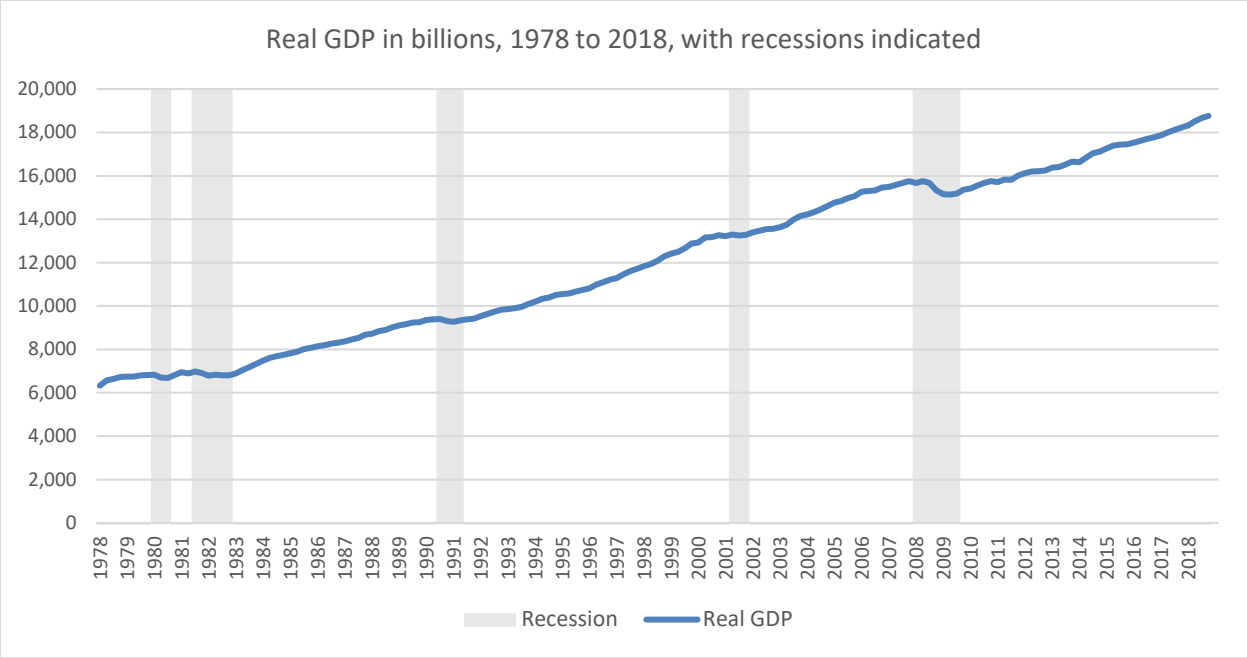


Source: Bureau of Labor Statistics, Occupational Employment Survey, 2003-2018 and Carpenters' Pension Trust Fund Actuarial Valuation documents, 2011-2018.

Although they are on different scales, the trend in Carpenter employment in Michigan has been reflected in the hours worked by members of the fund over the past 15 years.

The demand for Carpenters can fluctuate based on economic conditions. During an economic recession, it is not unusual to see a decrease in demand for many types of labor. The National Bureau of Economic Research (NBER) defines a recession as a "significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales."[3] Figure 4 shows the real Gross Domestic Product (GDP) in billions from 1978 to 2018, with NBER-defined recessions shown in the shaded areas.

Figure 4



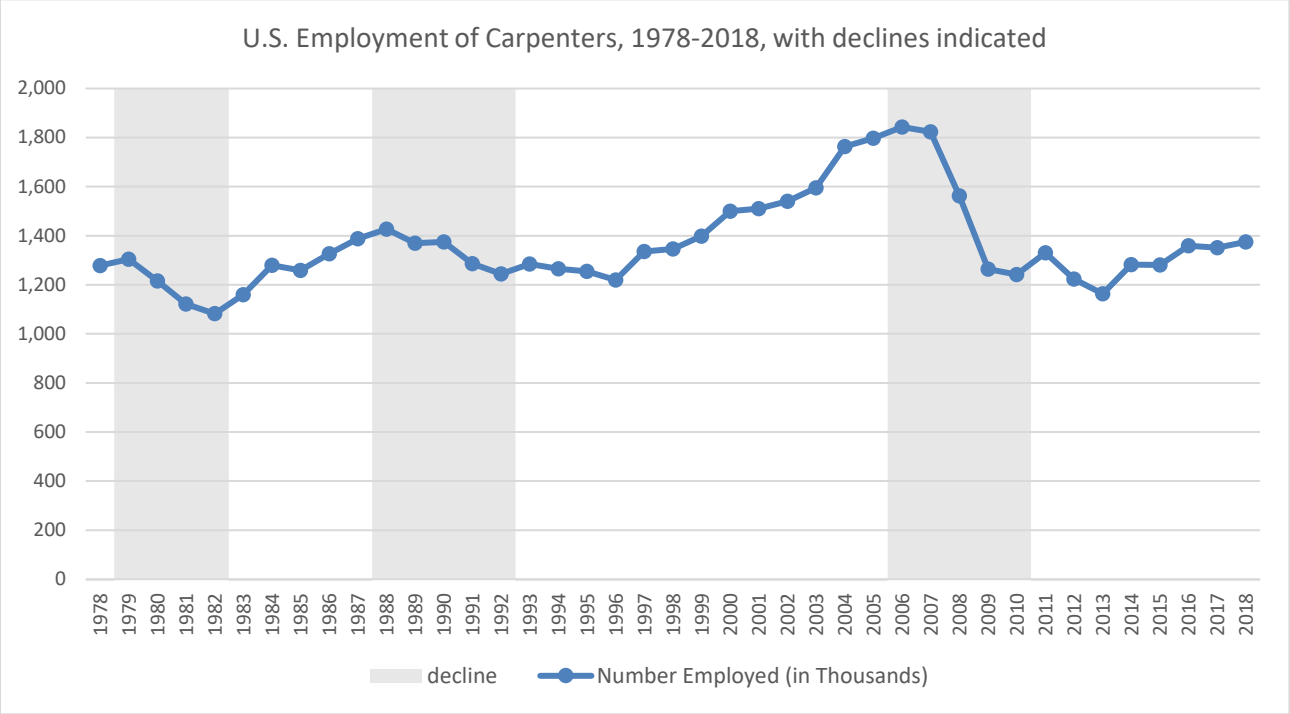
Source: Real GDP in billions of chained 2012 dollars, Quarterly, seasonally adjusted annual rate and recession data from Federal Reserve Economic Data (https://fred.stlouisfed.org).

Although there are quantitative methods for predicting the likelihood of future recessions, there is not a reliable way to predict precisely when a recession will begin or end, or how many will occur in a 20-year period. However, we can make projections which show likely future economic activity, adjusting for the possible impact of recessionary periods which can lead to declines in Carpenter employment. Since the NBER began measuring recessions in 1857 there has not been a 10-year period without a recession except the current cycle, June 2009 to present. Therefore, it seems probable that there will be at least one recession, and probably two, in the next 20 years.

[3] NBER website, http://www.nber.org/cycles/cyclesmain.html

Figure 5 shows the employment of Carpenters in the U.S. over the last 40 years. The shaded areas indicate, from peak to trough, declines in Carpenter employment in the United States. Historical data is based on the Current Population Survey (CPS) conducted by the United States Bureau of the Census.[4]

Figure 5



Source: United States Current Population Survey, Bureau of Labor Statistics.

In the last 40 years there have been three major declines in Carpenter employment, occurring from 1979-1982, 1988-1992, and 2006-2010. From 2006 to 2010, Carpenter employment dropped by 33%. Over the same time period, hours worked by carpenters in Michigan declined by 47%, from 11,200,000 to 5,900,000.

To estimate the impact of future declines, I have included a projection that assumes there will be two declines over the next 20 years that and that each will average 30%. I assume that employment will decline 15% during the first year, and bottom at 30% in the second year, then return to the 4.2% growth rate experienced by Carpenter hours from 2010 to 2018.

In this projection, shown in Figure 6, Carpenter hours will reach 7.7 million by 2038, but there is a 30% reduction in hours occurring over two years in 2021 and 2032.

[4] The count of Carpenters in the CPS differs from OES data because it includes persons self-reporting their occupation as a carpenter to the census bureau, where OES data is based on reporting by employers.

Figure 6

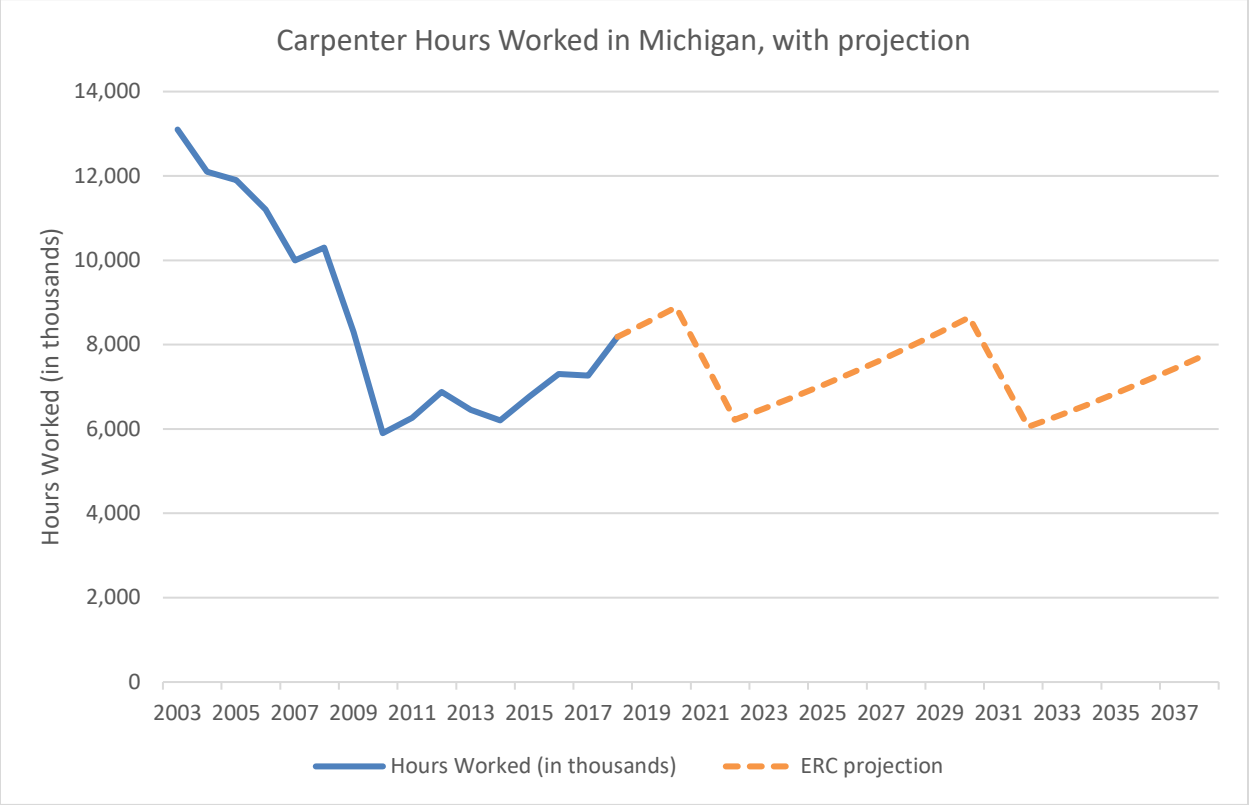


Table 1 provides the projection in manhours by year from 2019 to 2038.

Table 1: Projected Hours for Carpenters' Pension Fund – Detroit and Vicinity

Year	Projected Hours Worked
2019	8,528,350
2020	8,886,541
2021	7,553,560
2022	6,220,579
2023	6,481,843
2024	6,754,080
2025	7,037,752
2026	7,333,337
2027	7,641,337
2028	7,962,274
2029	8,296,689
2030	8,645,150
2031	7,348,377
2032	6,051,605
2033	6,305,772
2034	6,570,615
2035	6,846,581
2036	7,134,137
2037	7,433,771
2038	7,745,989

Conclusion

Based on my analysis of the various economic forecasts and projections I reviewed, it is my opinion that there is a strong possibility of one or more recessions occurring in the 20-year period of the projection, resulting in a decline in Michigan Carpenter hours from 2019 to 2038.

Carpenters

Summary

Summary

Quick Facts: Carpenters	
2019 Median Pay	$48,330 per year $23.24 per hour
Typical Entry-Level Education	High school diploma or equivalent
Work Experience in a Related Occupation	None
On-the-job Training	Apprenticeship
Number of Jobs, 2019	1,024,100
Job Outlook, 2019-29	0% (Little or no change)
Employment Change, 2019-29	-4,200

Carpenters are involved in many different types of construction.

What Carpenters Do

Carpenters construct, repair, and install building frameworks and structures made from wood and other materials.

Work Environment

Carpenters work indoors and outdoors on many types of construction projects, from installing kitchen cabinets to building highways and bridges.

How to Become a Carpenter

Carpenters typically learn on the job and through apprenticeships.

Pay

The median annual wage for carpenters was $48,330 in May 2019.

Job Outlook

Employment of carpenters is projected to show little or no change from 2019 to 2029.

State & Area Data

Explore resources for employment and wages by state and area for carpenters.

Similar Occupations

Compare the job duties, education, job growth, and pay of carpenters with similar occupations.

More Information, Including Links to O*NET

Learn more about carpenters by visiting additional resources, including O*NET, a source on key characteristics of workers and occupations.

What They Do ->

What They Do

About this section

What Carpenters Do

Carpenters construct, repair, and install building frameworks and structures made from wood and other materials.

Duties

Carpenters typically do the following:

- Follow blueprints and building plans to meet the needs of clients
- Install structures and fixtures, such as windows and molding
- Measure, cut, and shape wood, plastic, and other materials
- Construct and install building frameworks, including walls, floors, and doorframes
- Inspect and replace damaged framework or other structures and fixtures
- Instruct and direct laborers and other construction helpers

Carpenters have many different tasks. Some carpenters insulate office buildings; others install drywall or kitchen cabinets in homes. Still others focus on production or commercial work to help construct tall buildings or bridges, installing wooden concrete forms for cement footings or pillars. These carpenters also erect shoring and scaffolding for buildings.

Carpenters use many different tools to cut and shape wood, plastic, fiberglass, or drywall. They use handtools, including squares, levels, and chisels, as well as many power tools, such as sanders, circular saws, nail guns, and welding machines. On large projects, carpenters may use rigging hardware and cranes as part of the installation process. Carpenters may also use smart phones, tablets, and other personal electronic devices to assist with planning, drafting, or other calculations.

Carpenters work with different tools.

Carpenters fasten materials with nails, screws, staples, and adhesives and check their work to ensure that it is correct. They use tape measures or laser measures on nearly every project to quickly determine distances. Many employers require carpenters to supply their own tools on the job.

The following are examples of types of carpenters:

Construction carpenters construct, install, and repair structures and fixtures of wood, plywood, and wallboard, using carpenters' handtools and power tools.

Rough carpenters build rough wooden structures, such as concrete forms; scaffolds; tunnel, bridge, or sewer supports; and temporary frame shelters, according to sketches, blueprints, or oral instructions.

Wood flooring installers put in a variety of materials, including plank, strip, end-grain, and parquet flooring. These wood products may be nailed in place or glued down. Floor sanders and finishers may smooth the flooring onsite or it may be prefinished prior to installation.

<- Summary

Work Environment ->

Work Environment

Work Environment

About this section

Carpenters held about 1.0 million jobs in 2019. The largest employers of carpenters were as follows:

Self-employed workers	28%
Residential building construction	21
Nonresidential building construction	13
Building finishing contractors	12
Foundation, structure, and building exterior contractors	10

Self-employed carpenters often work in residential construction.

Carpenters work indoors and outdoors on many types of construction projects, from installing kitchen cabinets to building highways and bridges. Carpenters may work in cramped spaces and frequently alternate between lifting, standing, and kneeling. Those who work outdoors are subject to variable weather, which may affect a project's schedule.

Injuries and Illnesses

Carpenters sometimes get injured on the job, such as from strains caused by overexertion due to lifting and moving materials. Other common injuries result from falls, slips, trips, and contact with objects or equipment. Workers often wear equipment such as boots, hardhats, protective eyewear, and reflective vests as a safeguard against injuries.

Work Schedules

Most carpenters work full time, which may include evenings and weekends to meet clients' deadlines. Extreme temperatures or inclement weather may impact building construction timelines, which in turn may affect carpenters' work hours.

<- What They Do

How to Become One ->

How to Become One

How to Become a Carpenter

About this section

Carpenters typically need a high school diploma and learn on the job or through apprenticeships.

Education

A high school diploma or equivalent is typically required to enter the occupation. Certain high school courses, such as mathematics and mechanical drawing, may be useful. Some vocational-technical schools offer associate's degrees in carpentry. The programs vary in length and teach basics and specialties in carpentry.

Training

Carpenters typically learn on the job or through apprenticeships. They often begin doing simple tasks, such as measuring and cutting wood, under the guidance of experienced carpenters or other construction workers. They then progress to more complex tasks, such as reading blueprints and building wooden structures.

Apprentice carpenters learn by working with more experienced coworkers.

Several groups, such as unions and contractor associations, sponsor apprenticeship programs. For each year of a typical program, apprentices must complete a predetermined number of hours of technical training and paid on-the-job training. Apprenticeship program requirements differ based on the type of program and by region. Apprentices learn carpentry basics, blueprint reading, mathematics, building code requirements, and safety and first aid practices. They also may receive specialized training in creating and setting concrete forms, rigging, welding, scaffold building, and working within confined workspaces. All carpenters must pass the Occupational Safety and Health Administration (OSHA) 10-hour safety course.

Work Experience in a Related Occupation

Some carpenters work as construction laborers or helpers before becoming carpenters. Laborers and helpers learn tasks that are similar to those of carpenters.

Licenses, Certifications, and Registrations

Carpenters may need a driver's license to travel to jobsites.

Optional programs offer certification by specialty that may allow carpenters to find additional work opportunities or lead to career advancement. For example, the National Association of the Remodeling Industry offers various levels of certification for remodeling. The National Wood Flooring Association offers certification for installers, craftsman, and master craftsman.

Advancement

Carpenters are involved in many phases of construction and may have opportunities to become first-line supervisors, lead carpenters, independent contractors, or general construction supervisors.

Important Qualities

Business skills. Self-employed carpenters must conduct activities such as bidding on new jobs, tracking inventory, and directing workers.

Detail oriented. Carpenters must be able to precisely cut, measure, and modify the materials they work with.

Dexterity. Carpenters use many tools and need hand-eye coordination to avoid injuring themselves or damaging materials.

Interpersonal skills. Carpenters need to work as a member of a team, cooperating with and assisting others. They also may interact with customers.

Math skills. Carpenters frequently use math skills, including basic trigonometry, to calculate the area, size, and amount of material needed for the job.

Physical strength. Carpenters use heavy tools and materials that weigh up to 100 pounds. They also must be able to stand, climb, or bend for many hours.

Problem-solving skills. Carpenters may work independently with little guidance. They need to be able to modify building materials and make adjustments onsite to complete projects.

Reading comprehension skills. Carpenters need advanced reading ability to understand and follow complex instructions for installing certain products, such as doors.

<- Work Environment

Pay ->

Pay

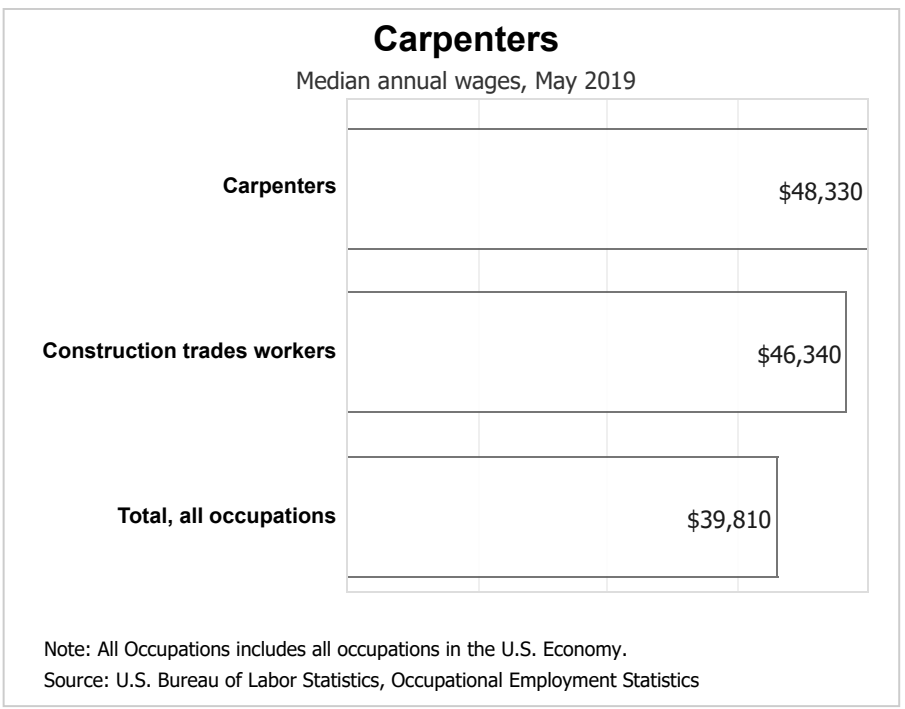
Pay

About this section

The median annual wage for carpenters was $48,330 in May 2019. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $30,170, and the highest 10 percent earned more than $84,690.

In May 2019, the median annual wages for carpenters in the top industries in which they worked were as follows:

Nonresidential building construction	$53,040
Building finishing contractors	49,440
Foundation, structure, and building exterior contractors	46,850
Residential building construction	46,290



The starting pay for apprentices is less than what fully trained carpenters make. As apprentices gain experience, they receive more pay.

Most carpenters work full time, which may include evenings and weekends to meet clients' deadlines. Extreme temperatures or inclement weather may impact building construction timelines, which in turn may affect carpenters' hours.

<- How to Become One

Job Outlook ->

Job Outlook

Job Outlook

About this section

Employment of carpenters is projected to show little or no change from 2019 to 2029.

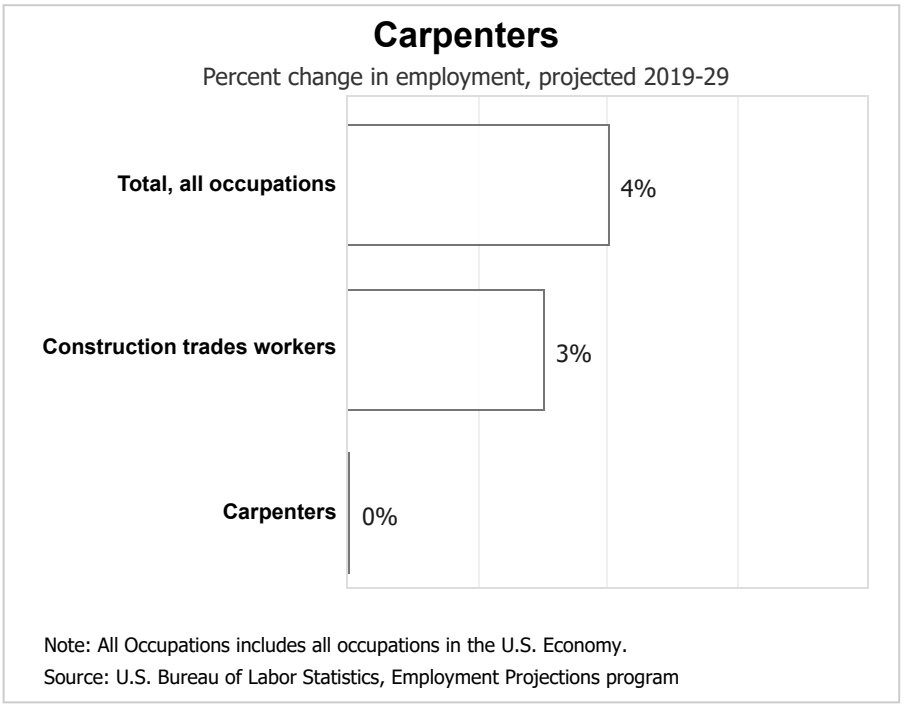
Population growth should result in more new-home construction—one of the largest segments employing carpenters—which will create some jobs for carpenters. Construction of factories and power plants is also expected to result in some new jobs over the decade.

However, the increasing popularity of modular and prefabricated components and homes reduces the need for carpenters to build and install them onsite. Roofs, bathrooms, windows, and buildings can be manufactured in a separate facility and then assembled onsite.

Job Prospects

About 89,000 openings for carpenters are projected each year, on average, over the decade.

Most of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force, such as to retire.



Overall job prospects for carpenters should be good as construction activity continues to increase. Prospective carpenters with a set of basic carpentry tools will have the best prospects.

Carpenters and other occupations in the construction industry are subject to periods of unemployment as building construction slows during cold months. Additionally, the number of job openings is expected to vary regionally, because different areas of the country are experiencing more development than others.

Employment projections data for carpenters, 2019-29

Occupational Title	SOC Code	Employment, 2019	Projected Employment, 2029	Change, 2019-29		Employment by Industry
				Percent	Numeric	
Carpenters	47-2031	1,024,100	1,019,900	0	-4,200	Get data
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						

<- Pay

State & Area Data ->

State & Area Data

State & Area Data

About this section

Occupational Employment Statistics (OES)

The Occupational Employment Statistics (OES) program produces employment and wage estimates annually for over 800 occupations. These estimates are available for the nation as a whole, for individual states, and for metropolitan and nonmetropolitan areas. The link(s) below go to OES data maps for employment and wages by state and area.

- Carpenters

Projections Central

Occupational employment projections are developed for all states by Labor Market Information (LMI) or individual state Employment Projections offices. All state projections data are available at www.projectionscentral.com . Information on this site allows projected employment growth for an occupation to be compared among states or to be compared within one state. In addition, states may produce projections for areas; there are links to each state's websites where these data may be retrieved.

CareerOneStop

CareerOneStop includes hundreds of occupational profiles with data available by state and metro area. There are links in the left-hand side menu to compare occupational employment by state and occupational wages by local area or metro area. There is also a salary info tool to search for wages by zip code.

<- Job Outlook

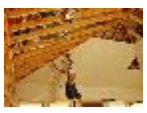
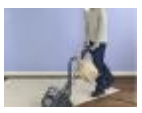
Similar Occupations ->

Similar Occupations

Similar Occupations

About this section

This table shows a list of occupations with job duties that are similar to those of carpenters.

	OCCUPATION	JOB DUTIES	ENTRY-LEVEL EDUCATION	2019 MEDIAN PAY
	Construction and Building Inspectors	Construction and building inspectors ensure that construction meets building codes and ordinances, zoning regulations, and contract specifications.	High school diploma or equivalent	$60,710
	Construction Laborers and Helpers	Construction laborers and helpers perform many tasks that require physical labor on construction sites.	See How to Become One	$36,000
	Drywall Installers, Ceiling Tile Installers, and Tapers	Drywall and ceiling tile installers hang wallboard and install ceiling tile inside buildings. Tapers prepare the wallboard for painting, using tape and other materials.	No formal educational credential	$47,360
	Flooring Installers and Tile and Marble Setters	Flooring installers and tile and marble setters lay and finish carpet, wood, vinyl, and tile.	No formal educational credential	$42,050
	General Maintenance and Repair Workers	General maintenance and repair workers fix and maintain machines, mechanical equipment, and buildings.	High school diploma or equivalent	$39,080
	Insulation Workers	Insulation workers install and replace the materials used to insulate buildings or mechanical systems.	See How to Become One	$44,180
	Roofers	Roofers replace, repair, and install the roofs of buildings.	No formal educational credential	$42,100
	Solar Photovoltaic Installers	Solar photovoltaic (PV) installers assemble, set up, and maintain rooftop or other systems that convert sunlight into energy.	High school diploma or equivalent	$44,890
	Woodworkers	Woodworkers manufacture a variety of products such as cabinets and furniture, using wood, veneers, and laminates.	High school diploma or equivalent	$32,690

<- State & Area Data

More Info ->

More Info

Contacts for More Information

About this section

For details about apprenticeships or other work opportunities in this trade, contact the offices of the state employment service, the state apprenticeship agency, local contractors or firms that employ carpenters, or local union–management carpenter apprenticeship committees. Apprenticeship information is available from the U.S. Department of Labor's Apprenticeship program online or by phone at 877-872-5627. Visit Apprenticeship.gov to search for apprenticeship opportunities.

For more information about carpenters, including training opportunities, visit

Associated Builders and Contractors

Associated General Contractors of America

Home Builders Institute

National Association of the Remodeling Industry

NCCER

National Wood Flooring Association

Occupational Safety and Health Administration

United Brotherhood of Carpenters and Joiners of America, Carpenters Training Fund

For more information about pre-apprenticeship training, visit

Home Builders Institute

National Building Trades Union

For information about opportunities for military veterans, visit:

Helmets to Hard Hats

O*NET

Carpenters

Construction Carpenters

Rough Carpenters

<- Similar Occupations

SUGGESTED CITATION:

Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Carpenters,
on the Internet at https://www.bls.gov/ooh/construction-and-extraction/carpenters.htm (visited *September 11, 2020*).

Last Modified Date: Thursday, September 10, 2020

U.S. Bureau of Labor Statistics Office of Occupational Statistics and Employment Projections PSB Suite 2135 2 Massachusetts Avenue NE Washington, DC 20212-0001
Telephone: 1-202-691-5700 www.bls.gov/ooh Contact OOH

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #26 - 6.04 Ten-year Experience for Certain Critical Assumptions

Does the application describe the plan's experience for certain critical assumptions, including a disclosure for each of the 10 plan years immediately preceding the application that separately identifies:

- *Total contributions;*
- *Total contribution base units;*
- *Average contribution rates;*
- *Withdrawal liability payments; and*
- *Rate of return on plan assets?*

See section 6.04 of Revenue Procedure 2017-43.

Document 26.1 describes the Pension Plan's experience for certain critical assumptions with respect to the above-listed factors.

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #26 - 6.04 Ten-year Experience for Certain Critical Assumptions

Document 26.1

Pension Plan's Ten-Year Experience for Certain Critical Assumptions

Plan Year Ending 4/30:	Base Units (Hours)	Average Hourly Rate	Contributions Excluding EWL Payments	EWL Payments	Return on Assets (Mkt Value)
2011	6,572,509	$ 9.95	$ 65,371,474	$ 55,520	10.62%
2012	7,131,329	11.62	82,849,388	1,355,000	-3.63%
2013	6,689,107	13.74	91,919,158	540,000	6.31%
2014	6,386,096	15.33	97,871,522	-	10.51%
2015	6,965,968	15.15	105,528,508	1,180,886	4.42%
2016	7,446,260	14.94	111,258,164	-	-0.22%
2017	7,478,853	14.27	106,706,279	-	11.13%
2018	8,332,526	14.78	123,139,985	7,236	7.87%
2019	7,795,753	14.56	113,494,825	3,100,521	6.65%
2020	7,212,686	15.12	109,035,749	52,500	-1.46%
Averages					
5-year	7,653,216	14.73	112,727,000	632,051	4.68%[1]
10-year	7,201,109	13.94	100,717,505	629,166	5.10%[1]

Sources

- Hours: 2011-2020 from most recent valuation data as of April 30, 2020
- Contributions Excluding EWL Payments and Return on Assets: 2011-2019 from audited financial statements, 2020 from unaudited financials
- EWL Payments: Supplied by Fund Counsel
- Average Contribution Rate: Calculated from other columns

[1] Geometric average shown

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Does the application include deterministic projections of the sensitivity of the plan's solvency ratio throughout the extended period by taking into account more conservative assumptions of investment experience and future contribution base units than assumed elsewhere in the application?

See Section 6.05 of Revenue Procedure 2017-43.

Document 27.1 helps the user gauge the sensitivity of deterministic projections of the Pension Plan's solvency ratio throughout the extended period to certain key assumptions. Note that, while the checklist description talks about using more conservative assumptions for future contribution base units, assuming that the 10-year trend continues into the future is actually more aggressive than the projection assumptions used elsewhere in this filing.

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Document 27.1

Pension Plan's Demonstration of Sensitivity of Projections

The following exhibits provide 4 separate, deterministic solvency ratio projections intended to help gauge the sensitivity of the projections to certain key assumptions as required by Section 6.05 of Revenue Procedure 2017-43. Each exhibit was prepared recognizing the proposed suspension. As permitted by Section 6.05, Exhibits III and IV do not recognize any change in expected benefit payments that may result from using alternate assumptions regarding future contribution base units.

- **Exhibit I** projects the Pension Plan's solvency ratio using assumed rates of return reduced by one percentage point (beginning with the plan year ending April 30, 2022);
- **Exhibit II** projects the Pension Plan's solvency ratio using assumed rates of return reduced by 2 percentage points (beginning with the plan year ending April 30, 2022);
- **Exhibit III** projects the Pension Plan's solvency ratio using a 1.04% contribution base unit trend (beginning with the plan year ending April 30, 2022), which is equal to the trend that the Pension Plan experienced over the 10 plan years ending April 30, 2020; and
- **Exhibit IV** projects the Pension Plan's solvency ratio using a 0.04% contribution base unit trend (beginning with the plan year ending April 30, 2022), which is equal to the trend assumed in Exhibit III reduced by one percentage point.

The assumed rates of return for Exhibits I and II are as shown below:

Plan Years Ending 4/30:	Assumed Rates of Return Used For:		
	Section 4.02(1) of Rev. Proc. 2017-43	Exhibit I	Exhibit II
2022-2030	6.50%	5.50%	4.50%
2031-2033	7.35%	6.35%	5.35%
2034-2046	6.75%	5.75%	4.75%
2047+	7.35%	6.35%	5.35%

The alternative rate of return assumptions above were assumed to first apply following the initial period. That is, the April 30, 2021 market value of plan assets is the same for all scenarios.

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Hours (contribution base units) increased from 6,572,509 in plan year ending April 30, 2011 to 7,212,686 in plan year ending April 30, 2020. This represents a compound annual increase of 1.04% per year for the 10-year period.

Based on the preceding calculation, the assumed work hours for Exhibits III and IV are as shown below:

Plan Year Ending 4/30:	Assumed Work Hours Used For:		
	Section 4.02(1) of Rev. Proc. 2017-43	Exhibit III	Exhibit IV
2022	7,000,000	7,363,490[1]	7,218,457[2]
2023	7,000,000	7,440,070	7,221,344
2024	6,900,000	7,517,447	7,224,233
2025	6,900,000	7,595,628	7,227,123
2026	6,900,000	7,674,623	7,230,014
2027+	6,900,000	increases @1.04%/yr.	increases @0.04%/yr.

The alternative work hours assumptions above were assumed to first apply following the initial period. That is, the April 30, 2021 market value of plan assets is the same for all scenarios.

[1] Hours for plan year ending April 30, 2020 (7,212,686) increased by 1.04% for 2 years (compounded)
[2] Hours for plan year ending April 30, 2020 (7,212,686) increased by 0.04% for 2 years (compounded)

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Exhibit I – Deterministic Projection of Solvency Ratio Recognizing Proposed Suspension and Using Assumed Rates of Return Reduced By One Percentage Point

The projected Solvency Ratio for Plan Years ending April 30, 2022 through April 30, 2056 using assumed rates of return reduced by one percentage point is shown below:

Plan Year Ending	1. Beginning Assets	2. Employer Contributions	3. EWL Payments Prior Wthdrwls	4. EWL Payments Future Wthdrwls	5. Benefit Payments	6. Expenses	7. Investment Income	8. Ending Assets	9. Resources (1)+(2)+(3)+(4)-(6)+(7)	Solvency Ratio (9)/(5)
4/30/2022	$718,511,349	$103,950,000	$36,159	$963,841	$133,717,059	$4,688,160	$38,598,106	$723,654,236	$857,371,295	6.41
4/30/2023	$723,654,236	$103,950,000	$36,159	$963,841	$130,564,993	$4,288,676	$38,978,632	$732,729,199	$863,294,192	6.61
4/30/2024	$732,729,199	$102,465,000	$36,159	$763,841	$133,219,618	$4,391,604	$39,355,585	$737,738,562	$870,958,180	6.54
4/30/2025	$737,738,562	$102,465,000	$36,159	$613,841	$136,150,959	$4,497,002	$39,543,464	$739,749,065	$875,900,024	6.43
4/30/2026	$739,749,065	$102,465,000	$36,159	$613,841	$139,043,884	$4,604,930	$39,571,519	$738,786,770	$877,830,654	6.31
4/30/2027	$738,786,770	$102,465,000	$36,159	$613,841	$141,877,505	$4,715,448	$39,437,629	$734,746,446	$876,623,951	6.18
4/30/2028	$734,746,446	$102,465,000	$36,159	$613,841	$144,612,729	$4,828,619	$39,137,080	$727,557,178	$872,169,907	6.03
4/30/2029	$727,557,178	$102,465,000	$36,159	$613,841	$147,351,216	$4,944,506	$38,663,175	$717,039,631	$864,390,847	5.87
4/30/2030	$717,039,631	$102,465,000	$36,159	$613,841	$149,892,369	$5,063,174	$38,011,565	$703,210,653	$853,103,022	5.69
4/30/2031	$703,210,653	$102,465,000	$36,159	$613,841	$152,168,711	$5,184,690	$37,931,807	$686,904,059	$839,072,770	5.51
4/30/2032	$686,904,059	$102,465,000	$36,159	$613,841	$154,210,241	$5,309,123	$41,827,569	$672,327,264	$826,537,505	5.36
4/30/2033	$672,327,264	$102,465,000	$36,159	$613,841	$155,935,480	$5,436,542	$40,843,121	$654,913,363	$810,848,843	5.20
4/30/2034	$654,913,363	$102,465,000	$12,056	$637,944	$157,264,909	$5,567,019	$35,940,657	$631,137,092	$788,402,001	5.01
4/30/2035	$631,137,092	$102,465,000	$7,236	$642,764	$158,038,895	$5,700,627	$34,547,428	$605,059,998	$763,098,893	4.83
4/30/2036	$605,059,998	$102,465,000	$7,236	$642,764	$158,434,253	$5,837,442	$33,032,695	$576,935,998	$735,370,251	4.64
4/30/2037	$576,935,998	$102,465,000	$7,236	$642,764	$158,473,879	$5,977,541	$31,410,398	$547,009,976	$705,483,855	4.45
4/30/2038	$547,009,976	$102,465,000	$3,618	$646,382	$158,241,874	$6,121,002	$29,692,197	$515,454,297	$673,696,171	4.26
4/30/2039	$515,454,297	$102,465,000	$0	$650,000	$157,476,679	$6,267,906	$27,895,522	$482,720,234	$640,196,913	4.07
4/30/2040	$482,720,234	$102,465,000	$0	$650,000	$156,552,426	$6,418,336	$26,035,560	$448,900,032	$605,452,458	3.87
4/30/2041	$448,900,032	$102,465,000	$0	$650,000	$155,088,226	$6,572,376	$24,128,566	$414,482,996	$569,571,222	3.67
4/30/2042	$414,482,996	$102,465,000	$0	$650,000	$153,489,329	$6,730,113	$22,191,020	$379,569,574	$533,058,903	3.47

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Exhibit I – Deterministic Projection of Solvency Ratio Recognizing Proposed Suspension and Using Assumed Rates of Return Reduced By One Percentage Point (Cont.)

Plan Year Ending	1. Beginning Assets	2. Employer Contributions	3. EWL Payments Prior Wthdrwls	4. EWL Payments Future Wthdrwls	5. Benefit Payments	6. Expenses	7. Investment Income	8. Ending Assets	9. Resources (1)+(2)+(3)+(4)-(6)+(7)	Solvency Ratio (9)/(5)
4/30/2043	$379,569,574	$102,465,000	$0	$650,000	$151,543,284	$6,891,636	$20,234,803	$344,484,457	$496,027,741	3.27
4/30/2044	$344,484,457	$102,465,000	$0	$650,000	$149,096,235	$7,057,035	$18,283,006	$309,729,193	$458,825,428	3.08
4/30/2045	$309,729,193	$102,465,000	$0	$650,000	$146,609,729	$7,226,404	$16,351,196	$275,359,256	$421,968,985	2.88
4/30/2046	$275,359,256	$102,465,000	$0	$650,000	$143,911,423	$7,399,838	$14,447,515	$241,610,510	$385,521,933	2.68
4/30/2047	$241,610,510	$102,465,000	$0	$650,000	$140,968,745	$7,577,434	$13,899,827	$210,079,158	$351,047,903	2.49
4/30/2048	$210,079,158	$102,465,000	$0	$650,000	$137,723,183	$7,759,292	$11,994,859	$179,706,542	$317,429,725	2.30
4/30/2049	$179,706,542	$102,465,000	$0	$650,000	$134,371,393	$7,945,515	$10,166,705	$150,671,339	$285,042,732	2.12
4/30/2050	$150,671,339	$102,465,000	$0	$650,000	$130,988,789	$8,136,207	$8,424,313	$123,085,656	$254,074,445	1.94
4/30/2051	$123,085,656	$102,465,000	$0	$650,000	$127,451,704	$8,331,476	$6,778,724	$97,196,200	$224,647,904	1.76
4/30/2052	$97,196,200	$102,465,000	$0	$650,000	$123,863,146	$8,531,431	$5,242,332	$73,158,955	$197,022,101	1.59
4/30/2053	$73,158,955	$102,465,000	$0	$650,000	$120,229,688	$8,736,185	$3,824,828	$51,132,910	$171,362,598	1.43
4/30/2054	$51,132,910	$102,465,000	$0	$650,000	$116,596,662	$8,945,853	$2,534,866	$31,240,261	$147,836,923	1.27
4/30/2055	$31,240,261	$102,465,000	$0	$650,000	$113,114,759	$9,160,553	$1,375,417	$13,455,366	$126,570,125	1.12
4/30/2056	$13,455,366	$102,465,000	$0	$650,000	$109,640,048	$9,380,406	$349,418	**insolvent**	$107,539,378	0.98

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Exhibit II – Deterministic Projection of Solvency Ratio Recognizing Proposed Suspension and Using Assumed Rates of Return Reduced By 2 Percentage Points

The projected Solvency Ratio for Plan Years ending April 30, 2022 through April 30, 2046 using assumed rates of return reduced by 2 percentage points is shown below:

Plan Year Ending	1. Beginning Assets	2. Employer Contributions	3. EWL Payments Prior Wthdrwls	4. EWL Payments Future Wthdrwls	5. Benefit Payments	6. Expenses	7. Investment Income	8. Ending Assets	9. Resources (1)+(2)+(3)+(4)-(6)+(7)	Solvency Ratio (9)/(5)
4/30/2022	$718,511,349	$103,950,000	$36,159	$963,841	$133,717,059	$4,688,160	$31,580,268	$716,636,398	$850,353,457	6.36
4/30/2023	$716,636,398	$103,950,000	$36,159	$963,841	$130,564,993	$4,288,676	$31,575,805	$718,308,534	$848,873,527	6.50
4/30/2024	$718,308,534	$102,465,000	$36,159	$763,841	$133,219,618	$4,391,604	$31,551,094	$715,513,406	$848,733,024	6.37
4/30/2025	$715,513,406	$102,465,000	$36,159	$613,841	$136,150,959	$4,497,002	$31,353,612	$709,334,057	$845,485,016	6.21
4/30/2026	$709,334,057	$102,465,000	$36,159	$613,841	$139,043,884	$4,604,930	$31,008,022	$699,808,265	$838,852,149	6.03
4/30/2027	$699,808,265	$102,465,000	$36,159	$613,841	$141,877,505	$4,715,448	$30,513,118	$686,843,430	$828,720,935	5.84
4/30/2028	$686,843,430	$102,465,000	$36,159	$613,841	$144,612,729	$4,828,619	$29,865,612	$670,382,694	$814,995,423	5.64
4/30/2029	$670,382,694	$102,465,000	$36,159	$613,841	$147,351,216	$4,944,506	$29,060,655	$650,262,627	$797,613,843	5.41
4/30/2030	$650,262,627	$102,465,000	$36,159	$613,841	$149,892,369	$5,063,174	$23,095,406	$621,517,490	$771,409,859	5.15
4/30/2031	$621,517,490	$102,465,000	$36,159	$613,841	$152,168,711	$5,184,690	$31,800,308	$599,079,397	$751,248,108	4.94
4/30/2032	$599,079,397	$102,465,000	$36,159	$613,841	$154,210,241	$5,309,123	$30,541,931	$573,216,964	$727,427,205	4.72
4/30/2033	$573,216,964	$102,465,000	$36,159	$613,841	$155,935,480	$5,436,542	$29,108,732	$544,068,674	$700,004,154	4.49
4/30/2034	$544,068,674	$102,465,000	$12,056	$637,944	$157,264,909	$5,567,019	$24,424,985	$508,776,731	$666,041,640	4.24
4/30/2035	$508,776,731	$102,465,000	$7,236	$642,764	$158,038,895	$5,700,627	$22,727,062	$470,879,271	$628,918,166	3.98
4/30/2036	$470,879,271	$102,465,000	$7,236	$642,764	$158,434,253	$5,837,442	$20,914,294	$430,636,870	$589,071,123	3.72
4/30/2037	$430,636,870	$102,465,000	$7,236	$642,764	$158,473,879	$5,977,541	$18,998,511	$388,298,961	$546,772,840	3.45
4/30/2038	$388,298,961	$102,465,000	$3,618	$646,382	$158,241,874	$6,121,002	$16,989,564	$344,040,649	$502,282,523	3.17
4/30/2039	$344,040,649	$102,465,000	$0	$650,000	$157,476,679	$6,267,906	$14,901,978	$298,313,042	$455,789,721	2.89
4/30/2040	$298,313,042	$102,465,000	$0	$650,000	$156,552,426	$6,418,336	$12,748,295	$251,205,575	$407,758,001	2.60
4/30/2041	$251,205,575	$102,465,000	$0	$650,000	$155,088,226	$6,572,376	$10,541,807	$203,201,780	$358,290,006	2.31
4/30/2042	$203,201,780	$102,465,000	$0	$650,000	$153,489,329	$6,730,113	$8,295,854	$154,393,192	$307,882,521	2.01

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Exhibit II – Deterministic Projection of Solvency Ratio Recognizing Proposed Suspension and Using Assumed Rates of Return Reduced By 2 Percentage Points (Cont.)

Plan Year Ending	1. Beginning Assets	2. Employer Contributions	3. EWL Payments Prior Wthdrwls	4. EWL Payments Future Wthdrwls	5. Benefit Payments	6. Expenses	7. Investment Income	8. Ending Assets	9. Resources (1)+(2)+(3)+(4)-(6)+(7)	Solvency Ratio (9)/(5)
4/30/2043	$154,393,192	$102,465,000	$0	$650,000	$151,543,284	$6,891,636	$6,019,829	$105,093,101	$256,636,385	1.69
4/30/2044	$105,093,101	$102,465,000	$0	$650,000	$149,096,235	$7,057,035	$3,732,263	$55,787,094	$204,883,329	1.37
4/30/2045	$55,787,094	$102,465,000	$0	$650,000	$146,609,729	$7,226,404	$1,445,260	$6,511,221	$153,120,950	1.04
4/30/2046	$6,511,221	$102,465,000	$0	$650,000	$143,911,423	$7,399,838	($835,378)	**insolvent**	$101,391,005	0.70

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Exhibit III – Deterministic Projection of Solvency Ratio Recognizing Proposed Suspension and Using a 1.04% Contribution Base Unit Trend

The projected Solvency Ratio for Plan Years ending April 30, 2022 through April 30, 2052 using a 1.04% contribution base unit trend is shown below:

Plan Year Ending	1. Beginning Assets	2. Employer Contributions	3. EWL Payments Prior Wthdrwls	4. EWL Payments Future Wthdrwls	5. Benefit Payments	6. Expenses	7. Investment Income	8. Ending Assets	9. Resources (1)+(2)+(3)+(4)-(6)+(7)	Solvency Ratio (9)/(5)
4/30/2022	$718,511,349	$109,347,826	$36,159	$963,841	$133,717,059	$4,688,160	$45,791,372	$736,245,328	$869,962,387	6.51
4/30/2023	$736,245,328	$110,485,044	$36,159	$963,841	$130,564,993	$4,288,676	$47,096,466	$759,973,169	$890,538,162	6.82
4/30/2024	$759,973,169	$111,634,088	$36,159	$763,841	$133,219,618	$4,391,604	$48,579,999	$783,376,034	$916,595,652	6.88
4/30/2025	$783,376,034	$112,795,083	$36,159	$613,841	$136,150,959	$4,497,002	$50,035,349	$806,208,505	$942,359,464	6.92
4/30/2026	$806,208,505	$113,968,152	$36,159	$613,841	$139,043,884	$4,604,930	$51,460,056	$828,637,899	$967,681,783	6.96
4/30/2027	$828,637,899	$115,153,420	$36,159	$613,841	$141,877,505	$4,715,448	$52,860,804	$850,709,170	$992,586,675	7.00
4/30/2028	$850,709,170	$116,351,016	$36,159	$613,841	$144,612,729	$4,828,619	$54,241,785	$872,510,623	$1,017,123,352	7.03
4/30/2029	$872,510,623	$117,561,067	$36,159	$613,841	$147,351,216	$4,944,506	$55,605,439	$894,031,407	$1,041,382,623	7.07
4/30/2030	$894,031,407	$118,783,702	$36,159	$613,841	$149,892,369	$5,063,174	$56,957,582	$915,467,148	$1,065,359,517	7.11
4/30/2031	$915,467,148	$120,019,052	$36,159	$613,841	$152,168,711	$5,184,690	$65,938,686	$944,721,485	$1,096,890,196	7.21
4/30/2032	$944,721,485	$121,267,250	$36,159	$613,841	$154,210,241	$5,309,123	$68,055,151	$975,174,522	$1,129,384,763	7.32
4/30/2033	$975,174,522	$122,528,430	$36,159	$613,841	$155,935,480	$5,436,542	$70,271,713	$1,007,252,643	$1,163,188,123	7.46
4/30/2034	$1,007,252,643	$123,802,725	$12,056	$637,944	$157,264,909	$5,567,019	$66,694,255	$1,035,567,695	$1,192,832,604	7.58
4/30/2035	$1,035,567,695	$125,090,274	$7,236	$642,764	$158,038,895	$5,700,627	$68,618,345	$1,066,186,792	$1,224,225,687	7.75
4/30/2036	$1,066,186,792	$126,391,213	$7,236	$642,764	$158,434,253	$5,837,442	$70,711,080	$1,099,667,390	$1,258,101,643	7.94
4/30/2037	$1,099,667,390	$127,705,681	$7,236	$642,764	$158,473,879	$5,977,541	$73,009,318	$1,136,580,969	$1,295,054,848	8.17
4/30/2038	$1,136,580,969	$129,033,820	$3,618	$646,382	$158,241,874	$6,121,002	$75,548,797	$1,177,450,710	$1,335,692,584	8.44
4/30/2039	$1,177,450,710	$130,375,772	$0	$650,000	$157,476,679	$6,267,906	$78,373,663	$1,223,105,560	$1,380,582,239	8.77
4/30/2040	$1,223,105,560	$131,731,680	$0	$650,000	$156,552,426	$6,418,336	$81,527,244	$1,274,043,722	$1,430,596,148	9.14
4/30/2041	$1,274,043,722	$133,101,689	$0	$650,000	$155,088,226	$6,572,376	$85,056,025	$1,331,190,834	$1,486,279,060	9.58
4/30/2042	$1,331,190,834	$134,485,947	$0	$650,000	$153,489,329	$6,730,113	$89,008,813	$1,395,116,152	$1,548,605,481	10.09

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Exhibit III – Deterministic Projection of Solvency Ratio Recognizing Proposed Suspension and Using a 1.04% Contribution Base Unit Trend (Cont.)

Plan Year Ending	1. Beginning Assets	2. Employer Contributions	3. EWL Payments Prior Wthdrwls	4. EWL Payments Future Wthdrwls	5. Benefit Payments	6. Expenses	7. Investment Income	8. Ending Assets	9. Resources (1)+(2)+(3)+(4)-(6)+(7)	Solvency Ratio (9)/(5)
4/30/2043	$1,395,116,152	$135,884,601	$0	$650,000	$151,543,284	$6,891,636	$93,431,204	$1,466,647,037	$1,618,190,321	10.68
4/30/2044	$1,466,647,037	$137,297,801	$0	$650,000	$149,096,235	$7,057,035	$98,384,240	$1,546,825,808	$1,695,922,043	11.37
4/30/2045	$1,546,825,808	$138,725,698	$0	$650,000	$146,609,729	$7,226,404	$103,922,702	$1,636,288,075	$1,782,897,804	12.16
4/30/2046	$1,636,288,075	$140,168,445	$0	$650,000	$143,911,423	$7,399,838	$110,095,313	$1,735,890,572	$1,879,801,995	13.06
4/30/2047	$1,735,890,572	$141,626,197	$0	$650,000	$140,968,745	$7,577,434	$127,357,535	$1,856,978,125	$1,997,946,870	14.17
4/30/2048	$1,856,978,125	$143,099,109	$0	$650,000	$137,723,183	$7,759,292	$136,424,191	$1,991,668,950	$2,129,392,133	15.46
4/30/2049	$1,991,668,950	$144,587,340	$0	$650,000	$134,371,393	$7,945,515	$146,494,994	$2,141,084,376	$2,275,455,769	16.93
4/30/2050	$2,141,084,376	$146,091,048	$0	$650,000	$130,988,789	$8,136,207	$157,649,592	$2,306,350,020	$2,437,338,809	18.61
4/30/2051	$2,306,350,020	$147,610,395	$0	$650,000	$127,451,704	$8,331,476	$169,975,264	$2,488,802,499	$2,616,254,203	20.53
4/30/2052	$2,488,802,499	$149,145,543	$0	$650,000	$123,863,146	$8,531,431	$183,566,469	$2,689,769,934	$2,813,633,080	22.72

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Exhibit IV – Deterministic Projection of Solvency Ratio Recognizing Proposed Suspension and Using a 0.04% Contribution Base Unit Trend

The projected Solvency Ratio for Plan Years ending April 30, 2022 through April 30, 2052 using a 0.04% contribution base unit trend is shown below:

Plan Year Ending	1. Beginning Assets	2. Employer Contributions	3. EWL Payments Prior Wthdrwls	4. EWL Payments Future Wthdrwls	5. Benefit Payments	6. Expenses	7. Investment Income	8. Ending Assets	9. Resources (1)+(2)+(3)+(4)-(6)+(7)	Solvency Ratio (9)/(5)
4/30/2022	$718,511,349	$107,194,091	$36,159	$963,841	$133,717,059	$4,688,160	$45,721,376	$734,021,597	$867,738,656	6.49
4/30/2023	$734,021,597	$107,236,969	$36,159	$963,841	$130,564,993	$4,288,676	$46,846,361	$754,251,258	$884,816,251	6.78
4/30/2024	$754,251,258	$107,279,863	$36,159	$763,841	$133,219,618	$4,391,604	$48,066,563	$772,786,462	$906,006,080	6.80
4/30/2025	$772,786,462	$107,322,775	$36,159	$613,841	$136,150,959	$4,497,002	$49,169,176	$789,280,452	$925,431,411	6.80
4/30/2026	$789,280,452	$107,365,704	$36,159	$613,841	$139,043,884	$4,604,930	$50,145,153	$803,792,495	$942,836,379	6.78
4/30/2027	$803,792,495	$107,408,651	$36,159	$613,841	$141,877,505	$4,715,448	$50,994,147	$816,252,340	$958,129,845	6.75
4/30/2028	$816,252,340	$107,451,614	$36,159	$613,841	$144,612,729	$4,828,619	$51,712,861	$826,625,467	$971,238,196	6.72
4/30/2029	$826,625,467	$107,494,595	$36,159	$613,841	$147,351,216	$4,944,506	$52,295,744	$834,770,084	$982,121,300	6.67
4/30/2030	$834,770,084	$107,537,593	$36,159	$613,841	$149,892,369	$5,063,174	$52,740,097	$840,742,231	$990,634,600	6.61
4/30/2031	$840,742,231	$107,580,608	$36,159	$613,841	$152,168,711	$5,184,690	$59,989,291	$851,608,729	$1,003,777,440	6.60
4/30/2032	$851,608,729	$107,623,640	$36,159	$613,841	$154,210,241	$5,309,123	$60,709,961	$861,072,966	$1,015,283,207	6.58
4/30/2033	$861,072,966	$107,666,689	$36,159	$613,841	$155,935,480	$5,436,542	$61,339,080	$869,356,713	$1,025,292,193	6.58
4/30/2034	$869,356,713	$107,709,756	$12,056	$637,944	$157,264,909	$5,567,019	$56,843,142	$871,727,683	$1,028,992,592	6.54
4/30/2035	$871,727,683	$107,752,840	$7,236	$642,764	$158,038,895	$5,700,627	$56,974,006	$873,365,007	$1,031,403,902	6.53
4/30/2036	$873,365,007	$107,795,941	$7,236	$642,764	$158,434,253	$5,837,442	$57,068,019	$874,607,272	$1,033,041,525	6.52
4/30/2037	$874,607,272	$107,839,059	$7,236	$642,764	$158,473,879	$5,977,541	$57,147,261	$875,792,172	$1,034,266,051	6.53
4/30/2038	$875,792,172	$107,882,195	$3,618	$646,382	$158,241,874	$6,121,002	$57,231,686	$877,193,177	$1,035,435,051	6.54
4/30/2039	$877,193,177	$107,925,348	$0	$650,000	$157,476,679	$6,267,906	$57,348,578	$879,372,518	$1,036,849,197	6.58
4/30/2040	$879,372,518	$107,968,518	$0	$650,000	$156,552,426	$6,418,336	$57,523,257	$882,543,531	$1,039,095,957	6.64
4/30/2041	$882,543,531	$108,011,706	$0	$650,000	$155,088,226	$6,572,376	$57,782,976	$887,327,611	$1,042,415,837	6.72
4/30/2042	$887,327,611	$108,054,910	$0	$650,000	$153,489,329	$6,730,113	$58,155,998	$893,969,077	$1,047,458,406	6.82

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #27 – 6.05 Demonstration of Sensitivity of Projections

Exhibit IV – Deterministic Projection of Solvency Ratio Recognizing Proposed Suspension and Using a 0.04% Contribution Base Unit Trend (Cont.)

Plan Year Ending	1. Beginning Assets	2. Employer Contributions	3. EWL Payments Prior Wthdrwls	4. EWL Payments Future Wthdrwls	5. Benefit Payments	6. Expenses	7. Investment Income	8. Ending Assets	9. Resources (1)+(2)+(3)+(4)-(6)+(7)	Solvency Ratio (9)/(5)
4/30/2043	$893,969,077	$108,098,132	$0	$650,000	$151,543,284	$6,891,636	$58,665,984	$902,948,273	$1,054,491,557	6.96
4/30/2044	$902,948,273	$108,141,371	$0	$650,000	$149,096,235	$7,057,035	$59,350,544	$914,936,918	$1,064,033,153	7.14
4/30/2045	$914,936,918	$108,184,628	$0	$650,000	$146,609,729	$7,226,404	$60,239,441	$930,174,854	$1,076,784,583	7.34
4/30/2046	$930,174,854	$108,227,902	$0	$650,000	$143,911,423	$7,399,838	$61,354,677	$949,096,172	$1,093,007,595	7.60
4/30/2047	$949,096,172	$108,271,193	$0	$650,000	$140,968,745	$7,577,434	$68,302,350	$977,773,536	$1,118,742,281	7.94
4/30/2048	$977,773,536	$108,314,501	$0	$650,000	$137,723,183	$7,759,292	$70,524,319	$1,011,779,881	$1,149,503,064	8.35
4/30/2049	$1,011,779,881	$108,357,827	$0	$650,000	$134,371,393	$7,945,515	$73,141,713	$1,051,612,513	$1,185,983,906	8.83
4/30/2050	$1,051,612,513	$108,401,170	$0	$650,000	$130,988,789	$8,136,207	$76,188,307	$1,097,726,994	$1,228,715,783	9.38
4/30/2051	$1,097,726,994	$108,444,531	$0	$650,000	$127,451,704	$8,331,476	$79,702,126	$1,150,740,471	$1,278,192,175	10.03
4/30/2052	$1,150,740,471	$108,487,909	$0	$650,000	$123,863,146	$8,531,431	$83,724,742	$1,211,208,545	$1,335,071,691	10.78

Carpenters Pension Trust Fund – Detroit and Vicinity
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Checklist Item #28 – 6.06 Projection of Funded Percentage

Does the plan include deterministic projections for each year in the extended period of:

- *the value of plan assets;*
- *the plan's accrued liability; and*
- *the plan's funded percentage?*

See section 6.06 of Revenue Procedure 2017-43.

Document 28.1 includes a deterministic projection for each year in the extended period of the value of the Pension Plan's assets, its accrued liability, and its funded percentage

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #28 – 6.06 Projection of Funded Percentage

Document 28.1

Pension Plan's Projection of Assets, Liabilities, and Funded Percentage

Exhibit I projects the Pension Plan's funded percentage using the value of plan assets and accrued liabilities during the extended period of April 30, 2021 through 2052. The projection includes the impact of benefit suspensions and is made on the same basis as Exhibit III of document 6.2 of Checklist Item #6.

Note that, as the suspension is assumed to be effective July 1, 2021, the April 20, 2021 liabilities do not reflect its impact. Liabilities and funded percentages were calculated using a discount rate of 7.50% (the discount rate utilized in the May 1, 2019 Actuarial Valuation Report).

Carpenters Pension Trust Fund – Detroit and Vicinity
EIN/Plan #: 38-6242188/001
Checklist Item #28 – 6.06 Projection of Funded Percentage

Exhibit I – Projections of Plan's Market Value of Assets, Accrued Liability, and Funded Percentage for Plan Years ending 2021 through 2052 Recognizing Proposed Suspension (beginning with April 30, 2022 liability and funded percentage)

As of April 30,	1. Market Value of Assets	2. Unit Credit Accrued Liability	3. Funded Percentage (1)/(2)
2021	$718,511,349	$2,275,068,764	31.58%
2022	$730,672,073	$1,763,409,887	41.44%
2023	$747,290,220	$1,774,931,364	42.10%
2024	$760,401,610	$1,784,201,264	42.62%
2025	$771,074,932	$1,790,839,057	43.06%
2026	$779,343,640	$1,794,674,996	43.43%
2027	$785,109,990	$1,795,589,503	43.72%
2028	$788,310,185	$1,793,432,518	43.96%
2029	$788,771,252	$1,787,978,879	44.12%
2030	$786,516,023	$1,779,221,030	44.21%
2031	$788,093,288	$1,767,177,557	44.60%
2032	$787,540,920	$1,751,843,193	44.95%
2033	$785,027,210	$1,733,343,604	45.29%
2034	$771,284,172	$1,711,962,740	45.05%
2035	$760,675,254	$1,688,109,205	45.06%
2036	$748,800,100	$1,662,005,167	45.05%

As of April 30,	1. Market Value of Assets	2. Unit Credit Accrued Liability	3. Funded Percentage (1)/(2)
2037	$735,937,583	$1,633,831,276	45.04%
2038	$722,298,378	$1,603,727,160	45.04%
2039	$708,377,685	$1,572,159,787	45.06%
2040	$694,317,285	$1,539,229,946	45.11%
2041	$680,662,186	$1,505,377,117	45.22%
2042	$667,575,167	$1,470,648,719	45.39%
2043	$655,449,523	$1,435,373,472	45.66%
2044	$644,864,054	$1,400,065,072	46.06%
2045	$635,959,406	$1,364,752,851	46.60%
2046	$629,063,781	$1,329,627,601	47.31%
2047	$628,199,194	$1,295,005,310	48.51%
2048	$630,447,355	$1,261,228,898	49.99%
2049	$636,142,657	$1,228,479,881	51.78%
2050	$645,565,779	$1,196,874,013	53.94%
2051	$659,146,128	$1,166,598,129	56.50%
2052	$677,237,767	$1,137,858,847	59.52%