THE IMPACTS OF PROJECT LABOR AGREEMENTS ON COMPETITION, COSTS, APPRENTICESHIPS, AND DIVERSITY

Evidence from Port of Seattle Projects

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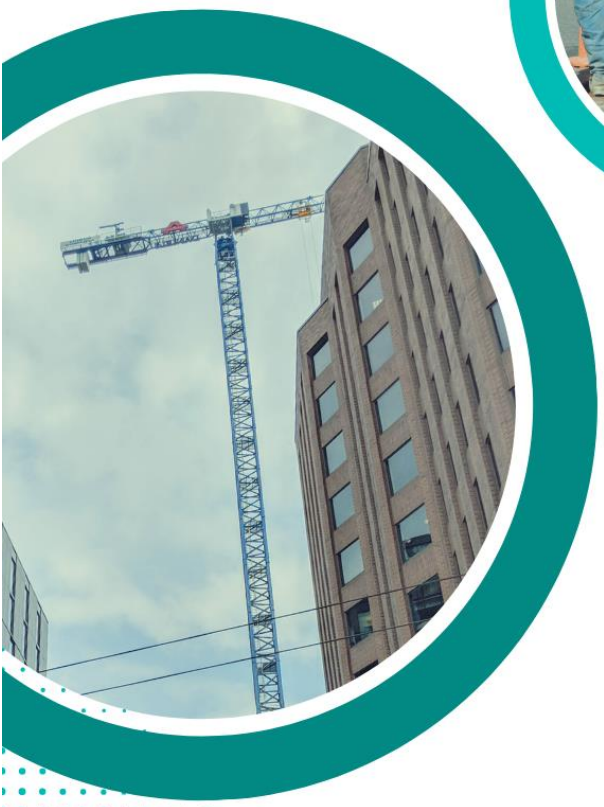

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PROJECT FOR MIDDLE CLASS RENEWAL

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Executive Summary

Project labor agreements (PLAs) are pre-hire agreements that establish terms and conditions of employment for all crafts on large infrastructure projects. The mutual agreements are between a construction owner—such as a contractor, developer, or public body—and a coalition of labor unions supplying skilled workers for the duration of the project. The main purpose of a PLA is to promote predictability, stability, and productivity on complex construction projects. PLAs ensure that taxpayer-funded projects utilize apprentices and expand work opportunities for people from historically disadvantaged backgrounds.

The Port of Seattle offers a unique case study to understand the impacts of PLAs. The Port has used PLAs on major public works projects since 1999. Most Port projects costing $5 million or more are covered by PLAs. Additionally, in October 2016, the Port Commission established apprenticeship utilization goals and encouraged aspirational hiring goals for people of color and women on projects costing $1 million or more.

An analysis of 95 aviation, seaport, and related major construction projects awarded by the Port of Seattle from October 2016 through February 2023—totaling more than $950 million in project value—reveals that:

- Bid competition averaged 4.3 bids on the 23 projects that were covered by PLAs and 3.7 bids on the 72 projects that were not.
- After accounting for important factors such as project size and complexity, the number of bids is not statistically different on PLA projects relative to non-PLA projects.
- PLAs have no effect on total construction costs, after accounting for project size and complexity, bid competition, and other factors.
- PLA projects were more likely to be awarded below the engineer's estimate (74 percent) than non-PLA projects (69 percent).
- There is evidence that PLAs reduce the average spread between the highest bid and the award amount to the low bidder—which is consistent with a policy that stabilizes public construction costs.

An evaluation of 55 Port of Seattle projects that had apprenticeship and aspirational hiring goals and employed apprentices in 2020, 2021, or 2022, including 20 PLA projects and 35 non-PLA projects, finds that:

- PLA projects had 5 percentage points more labor hours worked by apprentices.
- PLA projects were 23 percentage points more likely to achieve apprenticeship utilization goals.
- PLA projects were 26 percentage points more likely to meet women apprentice goals (55 percent) than non-PLA projects (29 percent).
- People of color accounted for a larger share of apprentice hours on PLA projects (37 percent) than on non-PLA projects (35 percent).

This first-of-its-kind study adds to the economic research on project labor agreements in three ways:

1. It assesses the impact of PLAs on a new type of public construction project—airports and seaports.
2. It examines more total bids than any study published in a peer-reviewed academic journal.
3. It offers direct evidence on the impact of PLAs on apprentices and expanding the diversity of the construction trades workforce.

Project labor agreements are valuable construction management tools. The data show project labor agreements are de-risking mechanisms that not only ban strikes and lockouts during construction and deliver access to skilled labor, but also have no effect on bid competition or construction costs while boosting apprenticeship training and expanding opportunities to people from historically underrepresented communities. These are especially important outcomes at a time when the industry is facing a labor shortage and contractors need new workers to build and repair trillions of dollars in American infrastructure.

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Introduction

Project labor agreements (PLAs) are pre-hire agreements covering all crafts on large and complex construction projects that establish terms and conditions of employment. The mutual agreements are between a construction owner—such as a general contractor, developer, or government or public body—and a coalition of labor unions for the duration of the project. A PLA "operates as a 'job-site constitution,' establishing safe working conditions and rules, project execution and accountability on the job, and protocols for resolving labor disputes without resorting to strikes and lockouts" (Waheed & Herrera, 2014).

The main purpose of a project labor agreement is to promote predictability, stability, and productivity on large infrastructure projects. A PLA is a "construction management tool" that establishes quality standards that private contractors must contractually meet (Kotler, 2011). For project owners, PLAs are de-risking mechanisms that typically include provisions for banning strikes and lockouts during construction, providing access to pools of skilled labor, and instituting uniform work rules and consistent shift work to reduce the chances of labor shortages. PLAs can also ensure that taxpayer funding achieves other positive outcomes. For example, PLAs include language to hire apprentices and individuals from underrepresented backgrounds (Ormiston & Duncan, 2022).

Project labor agreements have been applied to public projects since at least the 1930s (Mayer, 2010). The Tennessee Valley Authority, the nation's largest public power company, has used a master PLA since 1991 and entered into a 10-year extension through 2031 (Hill International, 2011; TVA, 2020). PLAs have been used on school construction projects, road construction projects, affordable housing projects, and large building projects (Ormiston & Duncan, 2022; Belman et al., 2010; Philips & Waitzman, 2021; Belman, Bodah, & Philips, 2007; Philips & Littlehale, 2015; Manzo & Bruno, 2015). In Illinois, Governor JB Pritzker reportedly signed more than 800 PLAs during his first term in office between 2019 and 2022, including nearly 200 Illinois Department of Transportation (IDOT) highway and bridge projects and over 600 Capital Development Board (CDB) building projects (Donald, 2022; EO 19-02, 2019). In 2022, President Joe Biden issued an Executive Order requiring that PLAs be used on federal construction projects worth $35 million or more, following a similar Executive Order encouraging PLAs on federal projects worth $25 million or more that was in place under President Barack Obama (Biden White House, 2022; Obama White House, 2009).

Project labor agreements also have a long history in the private sector, with many companies reporting that they prefer to have PLAs on complex projects (Hill International, 2011). Corporations like Apple, Intel, Honda, General Motors, British Petroleum, Proctor & Gamble, Dominion Energy, Micron Technology, Wal-Mart, and Disney regularly employ PLAs on large construction projects (McFarland, 2022; Moran, 2011; Mayer, 2010). Power plants and pipelines often utilize PLAs (BLE, 2005). Gaming companies like Bally's and Hard Rock Casino have signed PLAs to build casinos (Briggs, 2022; Clark & Carpello, 2021). In the National Football League (NFL), 12 of out 18 stadiums built or renovated between 1998 and 2016 were constructed with PLAs (67 percent) (BCTD, 2012). Between January 2022 and June 2023, there were PLAs on at least 428 public and private projects valued at $184 billion across the country (NABTU, 2023).

This report, conducted by researchers at the Illinois Economic Policy Institute and the Project for Middle Class Renewal at University of Illinois at Urbana-Champaign, evaluates the impact of project labor agreements on Port of Seattle infrastructure projects. The Port of Seattle has used PLAs on major public works projects since 1999 (Port of Seattle, 2024a). The report first discusses the existing research on PLAs before the Port of Seattle project data is detailed. Then, the effects of PLAs on the number of bidders, total construction costs, the share of projects awarded below their engineer's estimates, apprenticeship utilization rates, and equity goals are assessed on Port of Seattle projects awarded between the end of 2016 and the beginning of 2023. A discussion section follows before a conclusion recaps key findings.

Economic Research on the Effect of Project Labor Agreements

This section explores the extant economic research on PLAs. Despite their widespread use, project labor agreements have long been a topic of debate. Proponents of PLAs contend that they ensure job quality and market-competitive wages and benefits, a skilled workforce, uninterrupted labor supply, safety standards, and timely completion of projects within budget (Moran, 2011). Proponents also note that PLAs increase investments in registered apprenticeship training by including apprentice-to-journeyworker ratios and can incorporate local hire goals, which attract, train, and retain new workers into the construction industry during labor shortages and as older workers retire.

Critics argue that they increase costs by requiring union-scale wages and discourage competition from bidders—particularly from nonunion companies that do not want to provide union-scale wages and working standards for the duration of the project (Moran, 2011). It is important to note, however, that both union and nonunion contractors can bid on PLA projects. All public PLAs and most private PLAs explicitly allow union and nonunion contractors and subcontractors to bid on projects (Belman & Bodah, 2010; BLE, 2005). For example, President Joe Biden's Executive Order requiring PLAs on federal construction projects worth $35 million or more specifically "allow[s] all contractors and subcontractors on the construction project to compete for contracts and subcontracts without regard to whether they are otherwise parties to collective bargaining agreements" (Biden White House, 2022). The U.S. Department of Labor has also noted that "nonunion contractors can choose to bid on projects where PLAs are required or incentivized," ensuring open competition on taxpayer-funded projects (USDOL, 2024).

Construction Costs and Bid Competition

There are four peer-reviewed studies that have assessed the impact of PLAs on the cost of school construction projects. Three (75 percent) conclude that PLAs do not affect overall costs. Peer review is the process of establishing credibility by submitting research to a group of anonymous experts who independently evaluate methodologies and conclusions before being accepted for publication.[1]

One peer-reviewed study focused on 99 construction projects built at community colleges in California between 2007 and 2016 (Philips & Waitzman, 2021). After accounting for the size and complexity of the project through the engineer's estimate, the location of the project, the business cycle, and season when the project was awarded, the authors found that the presence of a PLA had no effect on construction costs (Philips & Waitzman, 2021). Another compared 70 elementary through secondary school construction projects built in Massachusetts from 1996 through 2002, including 9 that were covered by PLAs (Belman et al., 2010). The researchers collected information on dozens of characteristics for each school construction project. After accounting for project size and complexity, project location, and other important factors, the authors found no evidence that PLAs affected total construction costs. A third explored responsible contractor policies on school construction projects in Ohio, many of which included PLAs and others which incorporated similar "high-road" construction market standards such as prevailing wages and participation in apprenticeship training programs (Waddoups & May, 2014). The researchers evaluated 63 schools built with responsible contractor policies against 256 schools without such policies between 1997 and 2008 and

[1] In peer-reviewed studies and other rigorous analytics, researchers seek to account for all important factors that could influence an outcome to parse out the independent effects of the variable of interest. For example, in construction, building a new airport terminal in a major city in 2024 would cost significantly more than renovating a small restroom in a rural public park did in 2014. In this case, researchers would seek to control for the project size and complexity, the project type, whether it is new construction or a renovation, the location of the project, and either the year or a construction price index to account for inflation over time. More bid competition also tends to lower the final contract price, which is a factor that many researchers account for in estimating the impact of a policy, such as a PLA, on construction costs.

found that they had "no discernible statistical impact on construction bid costs" after controlling for geographic location and other factors (Waddoups & May, 2014).

On the other hand, an earlier 2007 study looked at 126 kindergarten through high school construction projects in Massachusetts between 1995 and 2003 and estimated that PLAs increased total construction costs by between 9 percent and 15 percent (Bachman & Haughton, 2007). The authors were affiliated with the Beacon Hill Institute, and produced five non-peer-reviewed articles on the impact of PLAs on the cost of school construction in Connecticut, New York, Ohio, New Jersey, and Connecticut again, which all found that PLAs increased costs (Bachman, Haughton, & Tuerck, 2004; Bachman & Tuerck, 2006; Bachman & Tuerck, 2017; Burke & Tuerck, 2019; Burke & Tuerck, 2020). However, the results of each of these studies have been called into question by a numerous academic researchers (Ormiston & Duncan, 2022; Kotler, 2011; Belman, Bodah, & Philips, 2007). The primary critiques are that the Beacon Hill Institute authors used "lean statistical models" that failed to account for project size and complexity and that they do not account for the location of construction, such as whether the project was completed in an urban area where costs are generally higher (Ormiston & Duncan, 2022). These methodological shortcomings likely biased and inflated their results.

In fact, another non-peer-reviewed study modeled closely after these articles assessed 108 New England school projects (Belman, Bodah, & Philips, 2007). The difference was that the authors gathered more detailed information on each school project, *including* whether the project was completed in an urban area as well as measures of project size and facility type being constructed—such as an auditorium, cafeteria, or kitchen. After accounting for 30 factors, PLAs had no statistically significant effect on school construction costs. Any cost effects, the researchers concluded, "likely have little to do with the PLA itself, but result from the additional amenities or requirements that are inherent in large, complex jobs, which are more likely to be covered by PLAs" (Belman, Bodah, & Philips, 2007).

The analysis of community college construction projects in California between 2007 and 2016 is the only peer-reviewed study to investigate bid competition (Philips & Waitzman, 2021). Over the 10-year period, there were 263 bids on these 99 projects, including 88 bids on projects covered by PLAs and 175 bids on non-PLA projects. After accounting for project size, project location, the business cycle, and the season when the project was awarded, the presence of a PLA had no effect on the number of bidders. Instead, the projects with PLAs had slightly more bidders than projects without PLAs, but that difference was not statistically significant (Philips & Waitzman, 2021).

There are also three non-peer-reviewed studies that have looked at bid competition. One compared a high school district to a unified school district that were both located in San Jose, California (Belman, Bodah, & Philips, 2007). The high school district chose to build with PLAs while the unified district did not. The researchers accessed 164 total projects, including 108 built prior to the PLA going into effect and 56 while it was in place—of which 21 were in the high school district covered by the PLA and 35 were in the unified school district and were not covered by a PLA. After accounting for other important factors, the PLA had "no statistically significant effect on the number of bidders" (Belman, Bodah, & Philips, 2007). Another explored 125 construction projects built in Washington State, including 62 with PLAs and 63 without (Bachman, Burke, & Tuerck, 2019). The report claimed that PLAs reduce bid competition by 0.8 bidders per project, but the authors did not account for the location of the project—specifically whether construction took place in Seattle, which could have accounted for differences on PLA and non-PLA projects (Ward, 2021). A third report looked within Seattle between 2015 and 2021 and found that the average number of prime contractors

bidding on projects covered by PLAs was the same (3.6 bids) as comparable projects conducted without PLAs (3.6 bids) (Seattle FAS, 2022).[2]

Other Outcomes: Completion Times, Cost Savings, Equity Goals, and Hiring Local

PLAs may be associated with other outcomes, including a timelier completion of projects and an improved attainment of local hire and industry recruitment goals. Qualitative interviews of industry representatives who have experience with PLAs reveal that they believe "the greatest benefit of PLAs [i]s in assuring timely completion of a project" (Belman, Bodah, & Philips, 2007). Many PLAs also specifically include language to local workers and workers from disadvantaged backgrounds (Ormiston & Duncan, 2022). In fact, from 1995 to 2010, an estimated 75 percent of PLAs promoted the hiring of veterans, 56 percent required hiring women and people of color, and 38 percent set local hiring goals (Figueroa, Grabelsky, & Lamare, 2011).

A cost effectiveness study by Hill International analyzed a PLA used by the New York City School Construction Authority from 2005 to 2009. The report found that the "total of major quantifiable cost savings resulting from utilization of a PLA in construction amount[ed] to $221 million" over five years, with most of the savings accruing from standardizing shift work and shift differentials (Hill International, 2011). Notably, although the collective bargaining agreements of all unions involved were renegotiated and two unions even went on strike during that five-year period, the PLA ensured that construction continued uninterrupted. That is, two unions went on strike at their other worksites—from apartment buildings to large developments to road construction projects in New York City—but, because the PLA was in place, they were prevented from doing so on school construction projects. Having the PLA in place was an insurance policy for taxpayers, lowering costs and enabling schools to open on time for children and parents.

A case study of seven buildings constructed between 2008 and 2015 at the College of Marin in California following a bond measure compared three projects completed under PLAs with four projects that were not (Waitzman & Philips, 2017). While all seven projects were completed under budget, the PLA-covered projects were awarded for 25 percent less than the engineer's estimates and the non-PLA projects were awarded for 21 percent less (Waitzman & Philips, 2017).

Another case study of 317 state building projects completed by the Illinois Capital Development Board under PLAs from 2011 through 2013 found positive outcomes (Manzo & Bruno, 2015). The data showed that the average winning low bid was 5 percent below the engineer's estimate, indicating that PLA projects came in on budget for taxpayers. In addition, Minority and Women Business Enterprise (MWBE) firms accounted for 12 percent of pre-qualified firms eligible to bid on these PLA-covered projects over this time and were awarded a proportionate share (13 percent) of their total construction value (Manzo & Bruno, 2015).

Public works projects built with PLAs are also completed faster than those built without PLAs. A forthcoming study of 292 infrastructure projects—including 59 covered by PLAs—constructed in Sacramento County, California between 2018 and 2023 used publicly available certified payroll records to evaluate the number of calendar days each project took to finish (Petrucci, Dunn, & Hinkel, 2023). Researchers found that, after accounting for project size, whether it occurred in an urban area, the awarding body, and other important factors, PLA-covered projects come in between 15 percent and 19 percent faster than non-PLA projects at statistically significant levels (Petrucci, Dunn, & Hinkel, 2023).

[2] Another example of competitive bidding is the New York State Energy Research and Development Authority, which required prospective lessees for its first wind farm to enter into good faith negotiations for a PLA, garnering 18 proposals from 4 developers, which was "the most competitive market response to date among all U.S. state offshore wind solicitations" (NYSERDA, 2019).

In the private sector, three recently built NFL stadiums offer additional examples of project labor agreements providing on-time project delivery. MetLife Stadium in New Jersey was built with a PLA and opened four months ahead of schedule (BCTD, 2012). US Bank Stadium in Minnesota was constructed with a PLA and was completed six weeks ahead of schedule, with 45 percent of the 7,500 jobs on the project held by women and people of color—exceeding the original target by 7 percentage points (BCTD, 2012; MMPS, 2013; US Bank Stadium, 2023; Glass & Walter, 2023). Allegiant Stadium in Las Vegas was built with a community benefits agreement that included a PLA, and the facility finished on time and on budget while meeting equity and local hire goals—with 63 percent of work hours performed by women and people of color, Nevada residents accounting for 80 percent of the workforce, and Nevada-based contractors doing 70 percent of the work (Slowey & Tyler March, 2018; Akers, 2020).

Port of Seattle Infrastructure Projects, Data, and Methodology

The Port of Seattle has used project labor agreements on major public works projects since 1999 (Port of Seattle, 2024a). The Port of Seattle is a government agency responsible for the Seattle-Tacoma International Airport, the international seaport and marinas in Seattle including cruise ship and container ship terminals, waterfront parks, its own police and fire departments, and an economic development division that overseas real estate projects, provides partnership grants to communities, and promotes tourism—among other programs and initiatives. In 2023, the Port of Seattle planned for total revenues of $1.3 billion, total expenses of $989 million, and total infrastructure expenditures of $726 million as part of a $5.3 billion five-year Capital Improvement Program (Port of Seattle, 2023a).

In October 2016, the Port Commission required "the establishment of apprenticeship and local hiring goals and aspirational hiring goals for women and people of color apprentices" on major construction and tenant-reimbursement contracts valued at $1 million or greater to create economic prosperity and ensure equity across the region (Port of Seattle, 2022). Importantly, only certain projects awarded by the Port of Seattle valued at $5 million or more are covered by PLAs while other projects, usually smaller, are not (Port of Seattle, 2018). The Port of Seattle evaluates every project on a case-by-case basis to determine whether a PLA should be applied. While projects with an engineer's estimate of more than $5 million start "in favor" of a PLA, other factors are considered to determine PLA coverage, according to Resolution 3725 (Port of Seattle, 2019).

On Port of Seattle projects that include PLAs in the bid specifications, all general contractors and subcontractors must abide by the terms and conditions of the PLA *for the awarded project only*.[3] Wages and benefits to "all laborers, workers, and mechanics who perform any part of the PLA within King County shall be in accordance with the current craft labor agreement as identified in their individual collective bargaining agreement" and all tradespeople are subject to a uniform substance abuse testing program for drugs and alcohol (Port of Seattle, 2024a). Nonunion contractors may use up to five "core" employees on PLA projects, provided that each passes a set of criteria and that each nonunion worker is matched with a subsequent union journeyworker referred by a hiring hall. After 10 total employees, each additional worker must be a union member (Port of Seattle, 2024a).

[3] The Port of Seattle's labor partners include: the Seattle/King County Building & Construction Trades Council, Laborers Local Union, Local No. 242, International Union of Painters and Allied Trades District Council 5 (and Sign Painters Local 1094), United Association of Plumbing and Pipefitting Industry, Local No. 32, Sheet Metal Workers International Association, Local No. 66, UA Sprinkler Fitters, Local No. 699, International Association of Machinists, Local 289, International Brotherhood of Electrical Workers Local 46, International Brotherhood of Teamsters Local 117, International Brotherhood of Teamsters Local 174, International Brotherhood of Teamsters Local 763, International Longshore & Warehouse Union, Local 9, the International Union of Operating Engineers, Local 302 , the Pacific NW Regional Council of Carpenters, Sea-Tac International Association of Firefighters, Local 1257, the Western Washington Cement Masons Local 528 (Port of Seattle, 2024c).

This analysis uses publicly available data on Port of Seattle infrastructure projects from four sources. Bid data on 95 major construction projects awarded between the fourth quarter of 2016 and the first quarter of 2023 were obtained from the "Current and Past Solicitations" Dashboard via VendorConnect (Port of Seattle, 2024b). This is the first source of data. The 95 major construction projects were awarded after the Port Commission enacted Resolution 3725 requiring "the establishment of appropriate apprentice hiring goals" for projects costing $1 million or greater (Port of Seattle, 2019). The 95 major construction projects all have complete information, including whether the contract was covered by a project labor agreement (PLA), the engineer's estimate of the project cost, whether the project has disadvantaged business enterprise (DBE) goals, the Division of the Port in which the project occurred, the month and year when bids were due from contractors, and the process for selecting the winning contractor—which is almost exclusively the low-bid procurement model but does include a design-build or general contractor/construction management model in a few instances. The projects also contain information from bid abstracts, including the number of bids submitted for each project, the award amount to the winning low bidder, the difference between the award amount (low bid) and the engineer's estimate, and the spread between the award amount and the proposed price submitted by the highest bidder (if multiple bids were submitted). The dataset includes projects with and without PLAs of differing sizes. Project costs ranged from $124,265 for a non-PLA project to $293,937,000 for a PLA-project. The largest project that was not covered by a PLA cost $52,000,000. Comparisons of projects across all sizes were made to determine the effect of PLAs.

To parse out the independent effects of a project labor agreement on the number of bids, total construction costs, the likelihood that a project is awarded below the engineer's estimate, and the bid spread, advanced but common statistical techniques called "regressions" are utilized. Regressions describe how much a variable is responsible for a particular outcome after accounting for other important factors. For example, a robust ordinary least squares (OLS) regression can evaluate how much a PLA increases or decreases the average cost of a Port of Seattle project after accounting for project size and complexity, the number of bidders, the Division of the project, the procurement type, and the award year. Similarly, a robust probit regression, with average marginal effects, can be used to understand how much PLAs increase or decrease the probability of a project coming in under the engineer's estimate after accounting for these factors. The regressions all control for the size and complexity of the project through the engineer's estimate, consistent with accepted practice in academic research (Philips & Waitzman, 2021; Belman et al., 2010; Waddoups & May, 2014; Duncan, 2015).

This analysis also uses publicly available data on apprenticeship utilization and the shares of women apprentices and people of color apprentices on active Port of Seattle projects in 2020, 2021, and 2022. The data come from the Port's *Apprenticeship and Priority Hire 2022 Annual Report*, *Apprenticeship and Priority Hire 2021 Annual Report*, and *Apprenticeship and Priority Hire 2020 Annual Report* (Port of Seattle, 2023c; Port of Seattle, 2022; Port of Seattle, 2021). These are the second, third, and fourth sources of data. This section of the analysis is limited to only projects that include apprenticeship utilization goals, which are all valued at $1 million or greater. Projects are included through their most recent year with available data. For example, if a project was only active in 2020 or 2021 or 2022, then it is included for that year. If a project was active in each of 2020, 2021, and 2022, then it is included only for 2022 because that includes the most recent and most complete data available.

In total, there are 55 projects with apprenticeship utilization data—53 of which are in the bid data and two that are not because they were awarded before the fourth quarter of 2016. Because the apprenticeship utilization data is more limited and it is not known with certainty which projects awarded in late 2022 and 2023 (after the data in the annual report was published) have apprenticeship goals, this section includes only simple t-tests to assess the relationship between PLAs and outcomes. Projects with PLAs are compared against projects without PLAs to determine whether a statistically significant difference exists for overall

apprenticeship utilization, the share of people of color apprentices, and the share of women apprentices. The "t-statistic" tells researchers whether the outcome has statistical significance or whether it occurred by chance. For there to be statistical significance at the traditional 95-percent level of confidence, the t-statistic must be ±1.96. Statistical significance with 90-percent confidence requires a t-statistic of ±1.65.

The Impacts of PLAs on Bid Competition and Costs on Port of Seattle Projects

Summary statistics for the 95 major construction projects awarded by the Port of Seattle from October 2016 through February 2023 are reported in Figure 1. The total value of all public construction work in the sample is just over $950 million, or an average value of $10.0 million per project, based on the amount awarded to the winning low bidder. There were 366 total bids, or 3.9 bids per project. About seven-in-ten projects occurred within the Aviation Division of the Port of Seattle (71 percent) and one-in-25 had a design-build, general contractor, or construction management framework (4 percent) (Figure 1).

The data indicate that projects that were covered by PLAs differ from those that were not in significant ways (Figure 1). There were 23 projects covered by PLAs, representing 24 percent of all projects in the sample. These projects had an average cost of $30.0 million, resulting in a cumulative investment of $689 million and accounting for 73 percent of total project value (or total spending on major public works projects by the Port of Seattle). About nine-in-ten PLA projects were on Aviation Division projects (91 percent). By contrast, on the 72 projects that were not covered by PLAs, the average cost was $3.6 million. Non-PLA projects had a total value of $261 million and fewer than two-in-three were on Aviation Division projects (65 percent).

FIGURE 1: SUMMARY STATISTICS ON PORT OF SEATTLE PROJECTS IN SAMPLE BY PLA STATUS, 2016Q4–2023Q1

Public Construction Metric	All Projects	PLA Projects	Non-PLA Projects
Total Number of Projects	95	23	72
Total Number of Bids	366	98	264
Bids Per Project	3.9	4.3	3.7
Average Project Value (Award Amount)	$10,006,608	$29,975,105	$3,627,788
Total Value of Projects (Award Amount)	$950,617,788	$689,427,406	$261,200,382
Division: Aviation	71.6%	91.3%	65.3%
Division: Maritime	14.7%	4.3%	18.1%
Division: All Others	13.7%	4.3%	16.7%
Procurement: Design-Build or GC/CM	4.2%	0.0%	5.6%
Projects Below Engineer's Estimates	70.5%	73.9%	69.4%
Spread: High Bid vs. Low Bid (Award Amount)	41.7%	27.1%	46.6%
Projects with DBE Goals	47.4%	60.9%	43.1%
Average Bid Year	2019.7	2020.3	2019.5

Source(s): Analysis of public bid data from Port of Seattle's "Current and Past Solicitations" Dashboard (Port of Seattle, 2024b).

PLA projects had more bidders, were more likely to fall below their engineer's estimates, had smaller spreads between the highest bid price and the winning low bid award amount, and were more likely to come with disadvantaged business enterprise (DBE) goals attached (Figure 1). On average, PLA projects received 4.3 bids from contractors while non-PLA projects had 3.7 bids per project, a 16 percent difference. Fully 74 percent of the PLA projects were awarded at amounts below the engineer's estimate while 69 percent of non-PLA projects came in below the engineer's estimate—a difference of 5 percentage points. On projects with multiple bidders, average bid spreads were 27 percent on PLA projects and 47 percent on non-PLA projects. Finally, about three-fifths of PLA projects had DBE goals in the contract specifications (61 percent) compared to fewer than half of non-PLA projects (47 percent).

Bid Competition

Statistical analyses of the bid data provide an opportunity to examine the effects of project labor agreements on bid competition and the cost of airport, seaport, and related public works projects. The models account for project size and complexity through the engineer's estimate. They also account for the Division of the project, whether an alternative to the low-bid procurement model was used (e.g., a design-build framework or a general contractor or construction manager approach), and the year of the bid letting. Findings are presented in Figure 2.

FIGURE 2: ROBUST REGRESSIONS ON BID COMPETITION AND CONSTRUCTION COSTS, PORT OF SEATTLE PROJECTS

Variables for Robust OLS Regressions	Bid Competition Number of Bids	Construction Costs Ln(Award Amount)
Project Labor Agreement	**+0.018 (0.628)**	**+0.042 (0.082)**
Number of Bids		-0.051*** (0.018)
Ln(Engineer's Estimate)	+0.171 (0.205)	+0.982*** (0.040)
Division: Aviation	-0.435 (0.485)	-0.062 (0.061)
Procurement: D-B or GC/CM	+0.259 (1.085)	-0.083 (0.186)
Bid Year: 2017	+1.174* (0.697)	+0.095 (0.172)
Bid Year: 2018	+1.098 (0.935)	+0.117 (0.259)
Bid Year: 2019	+0.699 (0.559)	+0.286 (0.170)
Bid Year: 2020	+1.201 (0.680)	+0.215 (0.177)
Bid Year: 2021	+1.659** (0.782)	+0.105 (0.174)
Bid Year: 2022	-0.106 (0.599)	+0.274 (0.173)
Bid Year: 2023	+0.789 (0.796)	+0.206 (0.166)
Constant	+0.696 (3.188)	+0.188 (0.652)
Sample Size (*N*=)	95	95
R^2	0.134	0.954

Source(s): Analysis of public bid data from Port of Seattle's "Current and Past Solicitations" Dashboard (Port of Seattle, 2024b). ***p<|0.01|; **p<|0.05|; *p<|0.10| (two-tailed tests). Standard errors are in parentheses. "Ln" refers to the natural logarithm, which is used to "normalize" the award amounts and engineer's estimates and effectively analyze the results in percentage terms.

The data reveal that project labor agreements have no effect on bid competition (Figure 2). After accounting for project size and complexity, the Port Division, the procurement type, and the year of the letting, the number of bids submitted by contractors is not statistically different on PLA projects relative to non-PLA

projects.[4] In fact, the only factor that influenced the number of bids was whether the project was awarded in 2021, which was associated with 1.7 additional bids per project at the 95 percent level of statistical confidence. Put simply, PLAs do not reduce the number of bidders on Port of Seattle infrastructure projects.

Construction Costs

There is no evidence that public works construction costs are higher due to project labor agreements (Figure 2). After accounting for project size and complexity, the number of bids submitted, the Division of the project, the procurement type, and the year of the letting, PLAs had no statistical effect on the award amount to the winning low bidder on Port of Seattle projects. In a near one-for-one ratio, the award amount—or winning bid price—is highly associated with the engineer's estimate. Greater levels of competition are also linked with with lower bid prices, reducing costs and saving money for taxpayers. Each additional bidder is statistically associated with a 5 percent decrease in the average winning bid price. The relationships of both the engineer's estimate and the number of bids on the award amount are significant with 99 percent confidence. PLAs, on the other hand, have no effect on winning bid prices.

Projects Awarded Below Engineer's Estimates

The share of projects that are awarded below their engineer's estimates can be a measure of efficiency in the construction industry. While the top priority is to deliver safe, high-quality infrastructure, project costs may come in above an engineer's estimate due to lack of bid competition, high project complexity, higher-than-expected prices for materials, and other factors. Risk of projects costing more than their engineer's estimates may be minimized by using professional contractors who employ highly skilled construction workers. After accounting for number of bids, project size and complexity, the Division of the project, the procurement type, and the year of the letting, Port of Seattle projects that were covered by PLAs were no more likely to come in below—or above—their engineer's estimates than those that were not (Figure 3). PLAs are not associated with higher-than-expected costs from contractors during the public procurement process.

Disparities in Bid Proposals

Figure 3 includes an indirect attempt to examine whether project labor agreements are associated with any added costs or inefficiencies by evaluating the average disparity between the contract amount proposed by the highest bidder and that proposed by the winning low bidder. This difference, the bid spread, is calculated as a percentage. Previous results show that PLAs have no effect on the winning low bid price and do not reduce the number of bids. If PLAs cause inefficiencies and overburden certain contractors, then wildly divergent bid spreads might be expected. Contractors who want to win large construction projects but who have to jump through allegedly onerous hoops to meet the PLA's terms and conditions would be compelled to submit significantly inflated losing bids if this were the case. However, when excluding the seven projects in which only one bid was submitted and only investigating bid data for the other 88 projects, this is not the case (Figure 3).

[4] Whether the project has disadvantaged business enterprise (DBE) goals was a variable of interest but could not be included in the analysis due to a problem in statistical analysis called "multicollinearity." During the period of analysis, projects became more likely to have DBE goals attached with each subsequent year. For example, in 2017 and 2018, only 6 percent of projects had DBE goals. In 2019 and 2020, the share was 53 percent. By 2021 and 2022, fully 69 percent of projects included DBE goals. The rise in DBE goals coincided with a global pandemic and a subsequent tightening labor market, which caused supply-chain problems and labor supply issues—leading to construction price increases and contractors opting not to bid on projects (e.g., see AGC, 2021; Swanek, 2021; Manzo, Petrucci, & Bruno, 2022). If DBE goals are included, the regression may capture these market changes and falsely attribute them to the DBE policy, rather than the "Bid Year" indicator variables.

FIGURE 3: ROBUST REGRESSIONS ON LOW BID COMING IN BELOW ESTIMATE AND BID SPREAD, PORT OF SEATTLE PROJECTS

Variables for Robust Regressions	Probit: Probability Below Engineer's Estimate	OLS: Bid Spread from High Bid to Low (Winning) Bid
Project Labor Agreement	**-0.113**	**-0.297***
	(0.139)	**(0.156)**
Number of Bids	+0.061**	+0.092***
	(0.026)	(0.035)
Ln(Engineer's Estimate)	+0.040	-0.004
	(0.050)	(0.050)
Division: Aviation	+0.076	-0.107
	(0.101)	(0.120)
Procurement: D-B or GC/CM	-0.410***	-0.027
	(0.160)	(0.245)
Bid Year: 2017	+0.149	-0.086
	(0.205)	(0.182)
Bid Year: 2018	+0.140	-0.003
	(0.227)	(0.252)
Bid Year: 2019	+0.035	-0.015
	(0.219)	(0.180)
Bid Year: 2020	-0.138	-0.050
	(0.230)	(0.205)
Bid Year: 2021	+0.175	+0.316
	(0.200)	(0.240)
Bid Year: 2022	-0.115	-0.110
	(0.217)	(0.205)
Bid Year: 2023		-0.399**
		(0.170)
Constant	+0.698***	+0.125
	(0.042)	(0.835)
Sample Size (*N*=)	93	88
R^2	0.189	0.317

Source(s): Analysis of public bid data from Port of Seattle's "Current and Past Solicitations" Dashboard (Port of Seattle, 2024b). ***p<|0.01|; **p<|0.05|; *p<|0.10| (two-tailed tests). Standard errors are in parentheses. NOTES: In the probabilistic probit regression "Bid Year: 2023" predicted success perfectly, meaning that two non-PLA projects awarded in 2023 both came in below the engineer's estimate and were dropped from the regression output. These projects were both awarded in February 2023 and their engineer's estimates were determined in the fourth quarter of 2022, according to the "Current and Past Solicitations" Dashboard. In the ordinary least squares (OLS) regression on the average bid spread, there are only 88 observations because 7 of the projects had only one bid submission.

After controlling for all the other important factors, there is evidence that PLAs are associated with a 30 percent decrease in the average spread between the highest bid and the award amount to the winning low bidder on Port of Seattle public works projects. This result is significant at the 90 percent level of statistical confidence. The only other statistically significant factor is the overall level of competition, with each additional bidder adding 9 percent to the total bid spread. Intuitively, this makes sense: the more bidders there are, the more likely there is to be an outlier submission. The effect from the number of bidders is significant with 99 percent confidence (Figure 3).

Analysis of Similarly-Sized Projects Near the Port's $5 Million Guideline

Lastly, Resolution 3725 simply states that "the Port shall evaluate the applicability of a project labor agreement (PLA) for each contract" and that "the assumption will be in favor of employing a PLA when projected construction labor costs are $5 million or greater" (Port of Seattle, 2019). This means that, while PLAs are often used on major construction projects costing $5 million or more, they are not mandated.[5] Nevertheless, an inspection into a subgroup of projects awarded near the $5 million guideline for PLA coverage may be instructive in further exploring whether PLAs have any effect.

Figure 4 explores Port of Seattle projects that were awarded to winning low bidders for between $2.5 million and $7.5 million. The subsample is comprised of 31 projects: 10 that were covered by PLAs and 21 that were not. The 10 PLA projects had an average winning bid price of $5.5 million, which was 39 percent higher than the $4.0 million average award amount to the 21 non-PLA projects in the subsample. However, the average engineer's estimates were $6.9 million for the PLA projects and $4.7 million for the non-PLA projects, respectively, meaning that the PLA projects were expected to be 47 percent more expensive overall. As a result, PLA projects near the $5 million guideline were more likely to come in below the engineer's estimate (80 percent) than non-PLA projects (57 percent). PLA projects also had more bidders (4.8 bids per project) than the non-PLA projects (4.1 bids per project). Despite having extra bidders, the spread between the highest price proposal and the winning low bid was smaller on the PLA projects (36 percent) than on the non-PLA projects (58 percent). Only the differences in award amounts and project size and complexity were statistically significant, but the results from this apples-to-apples comparison corroborate that PLAs have no negative impact on cost efficiency or bid competition for the projects that are most likely to be affected by the policy—which are those at or near the threshold level for consideration of coverage (Figure 4).

FIGURE 4: SUBSAMPLE OF PORT OF SEATTLE PROJECTS NEAR $5 MILLION PLA GUIDELINE, 2016Q4–2023Q1

Subsample: 30 Projects Awarded Between $2,500,000 and $7,500,000	10 PLA Projects	21 Non-PLA Projects	Percent Difference	
Average Project Value (Award Amount)	$5,514,217	$3,980,117	+38.5%	***
Average Engineer's Estimate	$6,859,778	$4,672,154	+46.8%	**
Share Below Engineer's Estimate	80.0%	57.1%	+22.9%	
Average Bids Per Project	4.8	4.1	+15.9%	
Spread: High Bid vs. Low Bid	36.0%	57.9%	-21.9%	

Source(s): Analysis of public bid data from Port of Seattle's "Current and Past Solicitations" Dashboard (Port of Seattle, 2024b). ***p<|0.01|; **p<|0.05|; *p<|0.10| (t-tests).

Takeaways

Results from 366 bids submitted on 95 public works projects awarded by the Port of Seattle between October 2016 and February 2023 find that project labor agreements promote robust bid competition and have no effect on overall construction costs. Projects with PLAs had slightly more bidders (4.3 per project) than projects without PLAs (3.7 per project) and projects with PLAs were slightly more likely to be awarded at prices below their engineer's estimates (74 percent) than projects without PLAs (69 percent). After accounting for other important factors, there is suggestive evidence that PLAs reduce the spread in prices submitted by the highest bidder and the winning low bidder, which could be due to the uniform terms and conditions of employment, safety standards, and improved access to skilled workers among contractors. This may reduce risk to the project owner, who may be more certain that another bid will come close to the

[5] As an example, a "2020 Airfield Pavement Replacement" project was a large project awarded for nearly $12 million that was not subject to a PLA (Port of Seattle, 2021; Port of Seattle, 2024d).

engineer's estimate if the lowest bid from an apparent winner is later withdrawn or rejected for any reason. Ultimately, the results are consistent in concluding that project labor agreements stabilize the costs of public works construction projects.

The Impacts of PLAs on Apprenticeship Utilization and Diversity on Port of Seattle Projects

In October 2016, the Port of Seattle's Port Commission enacted Resolution 3725, which required "the establishment of appropriate apprentice hiring goals" and encouraged "aspirational women and minority apprentice hiring goals" for contracts $1 million in value or greater (Port of Seattle, 2019). The policy directs Port staff to collaborate with contractors, construction unions, apprenticeship programs, and government agencies to recruit and train apprentices and pre-apprentices, particularly from disadvantaged backgrounds, to expand opportunities and meet industry needs (Port of Seattle, 2022). Each year, the Port releases data on apprenticeship utilization and the diversity of apprentices on construction worksites that are subject to these apprenticeship utilization and diversity goals. The Port released *Apprenticeship and Priority Hire Annual Report 2022* in April 2023, with two previous versions in August 2022 and August 2021 (Port of Seattle, 2023b; Port of Seattle, 2022; Port of Seattle, 2021).

This section is thus limited to projects valued at $1 million or greater that included apprenticeship and aspirational hiring goals and employed active apprentices in 2020, 2021, or 2022, or a mix of those years. According to the Port of Seattle's reports, there were 30 such projects in 2020 (13 PLA projects and 17 non-PLA projects), 40 applicable projects in 2021 (18 PLA projects and 22 non-PLA projects), and 40 applicable projects in 2022 (22 PLA projects and 18 non-PLA projects) (Port of Seattle, 2023b; Port of Seattle, 2022; Port of Seattle, 2021). However, there are projects for which construction activity occurred in more than one of these years. Only information through the most recent year is included for these projects because the data reports apprenticeship hours, people of color apprentice hours, and women apprentice hours over the life of the contract.

After removing the duplicates from the 2020 and 2021 reports and those without bid data, there are 55 total projects with apprenticeship utilization data. Of these, 20 are covered by PLAs and 35 are not. Figures 5 through 10 use "t-tests" to compare projects with PLAs against projects without PLAs to determine whether statistically significant differences exist for overall apprenticeship utilization, the share of people of color apprentices, and the share of women apprentices.

FIGURE 5: T-TEST ON APPRENTICESHIP UTILIZATION RATES FOR PLA AND NON-PLA PROJECTS WITH GOALS, 2020-2022

Overall Apprenticeship Utilization Rates: Project-Level for Those with Apprenticeship Goals			
Active Projects in 2020, 2021, and 2022	**Number**	**Average**	**Standard Error**
PLA Projects	20	21.9%	1.5%
Non-PLA Projects	35	16.5%	1.5%
PLA Difference	--	*+5.4%*	*2.3%*
t-statistic		**+2.36**	
Statistically Significant?		**YES**	

Source(s): Analysis of public project data from Port of Seattle's *Apprenticeship and Priority Hire 2022 Annual Report*, *Apprenticeship and Priority Hire 2021 Annual Report* and *Apprenticeship and Priority Hire 2020 Annual Report* (Port of Seattle, 2023b; Port of Seattle, 2022; Port of Seattle, 2021). Analysis is limited to only projects that include apprenticeship utilization goals, which are all valued at $1 million or more. The result is significant at the 95-percent level of statistical confidence ($p<|0.01|$).

Port of Seattle projects that are covered by project labor agreements have higher levels of apprenticeship utilization than those that are not (Figure 5). The project-level average share of labor hours performed by apprentices was 22 percent on active PLA projects from 2020 through 2022, which was 5 percentage points

higher than on non-PLA projects over the same time (or 17 percent higher). This difference is statistically significant.

It is worth noting that this is a project-level assessment and is not weighted by project size or the total number of labor hours. The objective in Figure 5 is to understand whether any given project is more or less likely to employ apprentices based on the presence of a PLA. Yet, this project-level analysis is similar to the overall aggregated data. For example, in its 2021 report, the Port of Seattle noted that apprentices comprised 22 percent of total labor hours on all PLA projects combined—accounting for more than 1.1 million hours worked and over $41 million in wages and benefits paid to apprentices—versus just 13 percent of total hours on non-PLA projects (Port of Seattle, 2022).

Importantly, the Port Commission has established a goal that no less than 15 percent of contract labor hours on all Port of Seattle projects be performed by apprentices (Port of Seattle, 2022). This Port-wide goal was largely met thanks to PLA projects, which have 15 percent apprentice ratios for each craft employed on the project for its entire duration. According to the data, 16 of the 20 PLA projects (80 percent) utilized apprentices for at least 15 percent of total labor hours through the life of their contracts compared to 20 of the 35 non-PLA projects (57 percent). Consequently, PLA projects were 23 percentage points more likely to meet or exceed their apprenticeship utilization rate goals than non-PLA projects. This difference is statistically significant at the 90-percent level of statistical confidence (Figure 6).

FIGURE 6: T-TEST ON SHARE OF PROJECTS WITH 15 PERCENT OR MORE APPRENTICESHIP HOURS, 2020-2022

Share of Projects with 15 Percent or More of All Contract Labor Hours Performed by Apprentices: Project-Level for Those with Apprenticeship Goals			
Active Projects in 2020, 2021, and 2022	**Number**	**Average**	**Standard Error**
PLA Projects	20	80.0%	9.2%
Non-PLA Projects	35	57.1%	8.5%
PLA Difference	--	*+22.9%*	*13.2%*
t-statistic		**+1.73**	
Statistically Significant?		**YES***	

Source(s): Analysis of public project data from Port of Seattle's *Apprenticeship and Priority Hire 2022 Annual Report*, *Apprenticeship and Priority Hire 2021 Annual Report* and *Apprenticeship and Priority Hire 2020 Annual Report* (Port of Seattle, 2023b; Port of Seattle, 2022; Port of Seattle, 2021). Analysis is limited to only projects that include apprenticeship utilization goals, which are all valued at $1 million or more. *The result is only significant at the 90-percent level of statistical confidence ($p<|0.10|$).

The Port of Seattle also establishes aspirational goals—or guidelines—for the share of apprentices who are women and people of color. The goals on projects that cost at least $1 million but are not subject to PLAs are that 10 percent of apprenticeship hours be performed by women and 15 percent of apprenticeship hours be performed by people of color. For projects that are covered by PLAs, the women and people of color goals can be more ambitious: at least 10 percent but as much as 12 percent for women apprentices and at least 15 percent but as much as 21 percent for people of color apprentices (Port of Seattle, 2022).

PLA projects tend to have a higher share of apprentices who are women (Figures 7 and 8). The project-level average share of apprenticeship hours performed by women was 13 percent on PLA projects compared to 10 percent on non-PLA projects. Women accounted for 3 percentage points more apprenticeship hours on PLA projects (Figure 7). PLA projects were twice as likely to meet women apprenticeship goals. Fully 11 of the 20 PLA projects (55 percent) met their women apprentice goals, while only 10 of the 35 non-PLA projects did (29 percent), a PLA advantage of 26 percentage points that is statistically significant (Figure 8).

The results are more mixed for people of color apprentices, although the data still indicates a positive effect (Figures 9 and 10). The share of apprenticeship hours performed by people of color was 37 percent on the average PLA project while it was under 35 percent on non-PLA projects—a difference of 2 percentage points (Figure 9). A total of 17 PLA projects (85 percent) met their people of color apprentice goals compared to 24 non-PLA projects (69 percent). PLA projects thus had a 16 percentage-point lead over the alternative (Figure 10). Due to the small sample size, however, both the PLA difference in the share of apprenticeship hours performed by people of color and the PLA difference in meeting people of color apprentice goals are not statistically significant.

FIGURE 7: T-TEST ON SHARE OF WOMEN APPRENTICES FOR PLA AND NON-PLA PROJECTS WITH GOALS, 2020-2022

Share of Women Apprentices: Project-Level for Those with Apprenticeship Goals			
Active Projects in 2020, 2021, and 2022	**Number**	**Average**	**Standard Error**
PLA Projects	20	12.7%	1.8%
Non-PLA Projects	35	9.5%	3.2%
PLA Difference	--	*+3.2%*	*4.4%*
t-statistic		**+0.72**	
Statistically Significant?		**NO**	

Source(s): Analysis of public project data from Port of Seattle's *Apprenticeship and Priority Hire 2022 Annual Report*, *Apprenticeship and Priority Hire 2021 Annual Report* and *Apprenticeship and Priority Hire 2020 Annual Report* (Port of Seattle, 2023c; Port of Seattle, 2022; Port of Seattle, 2021). Analysis is limited to only projects that include apprenticeship utilization goals, which are all valued at $1 million or more. *The result is not statistically significant.

FIGURE 8: T-TEST ON SHARE OF PROJECTS MEETING WOMEN APPRENTICE GOALS, 2020-2022

Share of Projects Meeting Women Apprentice Goal: Project-Level for Those with Apprenticeship Goals			
Active Projects in 2020, 2021, and 2022	**Number**	**Average**	**Standard Error**
PLA Projects	20	55.0%	11.4%
Non-PLA Projects	35	28.6%	7.7%
PLA Difference	--	*+26.4%*	*13.4%*
t-statistic		**+1.97**	
Statistically Significant?		**YES**	

Source(s): Analysis of public project data from Port of Seattle's *Apprenticeship and Priority Hire 2022 Annual Report*, *Apprenticeship and Priority Hire 2021 Annual Report* and *Apprenticeship and Priority Hire 2020 Annual Report* (Port of Seattle, 2023b; Port of Seattle, 2022; Port of Seattle, 2021). Analysis is limited to only projects that include apprenticeship utilization goals, which are all valued at $1 million or more. The result is significant at the 95-percent level of statistical confidence (p<|0.05|).

FIGURE 9: T-TEST ON SHARE OF PEOPLE OF COLOR APPRENTICES FOR PLA AND NON-PLA PROJECTS, 2020-2022

Share of People of Color Apprentices: Project-Level for Those with Apprenticeship Goals			
Active Projects in 2020, 2021, and 2022	**Number**	**Average**	**Standard Error**
PLA Projects	20	37.2%	4.3%
Non-PLA Projects	35	34.9%	5.1%
PLA Difference	--	*+2.3%*	*7.5%*
t-statistic		**+0.31**	
Statistically Significant?		**NO**	

Source(s): Analysis of public project data from Port of Seattle's *Apprenticeship and Priority Hire 2022 Annual Report*, *Apprenticeship and Priority Hire 2021 Annual Report* and *Apprenticeship and Priority Hire 2020 Annual Report* (Port of Seattle, 2023b; Port of Seattle, 2022; Port of Seattle, 2021). Analysis is limited to only projects that include apprenticeship utilization goals, which are all valued at $1 million or more. *The result is not statistically significant.

FIGURE 10: T-TEST ON SHARE OF PROJECTS MEETING PEOPLE OF COLOR APPRENTICE GOALS, 2020-2022

Share of Projects Meeting People of Color Apprentice Goal: Project-Level for Those with Apprenticeship Goals			
Active Projects in 2020, 2021, and 2022	**Number**	**Average**	**Standard Error**
PLA Projects	20	85.0%	8.2%
Non-PLA Projects	35	68.6%	8.0%
PLA Difference	--	*+16.4%*	*12.2%*
t-statistic		**+1.34**	
Statistically Significant?		**NO**	

Source(s): Analysis of public project data from Port of Seattle's *Apprenticeship and Priority Hire 2022 Annual Report*, *Apprenticeship and Priority Hire 2021 Annual Report* and *Apprenticeship and Priority Hire 2020 Annual Report* (Port of Seattle, 2023b; Port of Seattle, 2022; Port of Seattle, 2021). Analysis is limited to only projects that include apprenticeship utilization goals, which are all valued at $1 million or more. *The result is not statistically significant.

Port of Seattle data offers a direct case study on the potential impact of project labor agreements on expanding apprenticeships and the diversity of the construction workforce supply pool. The Port of Seattle data from 55 public works projects valued at $1 million or greater reveals that PLA projects have higher levels of apprenticeship utilization and are more likely to meet aspirational goals for hiring women apprentices. Evidence also suggests that PLA projects employ higher shares of apprentices who are people of color.

Discussion: Prevailing Wages and Unions in Construction

There are two labor market factors that must be discussed in the context of the Port of Seattle data. The first is that all projects in the sample were covered by the Washington State Prevailing Wages on Public Works Act, also known as the "Prevailing Wage Law" (LNI, 2020). Washington has a strong prevailing wage law, with rates determined by wages and benefits that have been privately negotiated between unions and employers in collective bargaining agreements (CBAs) (LNI, 2024). Accordingly, construction trade unions and their impacts are the second labor market institution that should be considered.

Prevailing Wage Laws

State prevailing wage laws establish minimum wages for different types of skilled construction workers on taxpayer-funded and taxpayer-subsidized projects, based on wages, benefits, and workforce training investments that are paid for similar work in the local area where the projects are to be completed. By preventing public bodies from awarding bids to contractors that pay less than the privately negotiated local market rate, prevailing wage laws promote a level playing field for local businesses and ensure that more workers can afford to live in the communities where they are building public works projects. The Davis-Bacon Act of 1931 establishes prevailing wages on federally funded and assisted construction projects. Additionally, 29 states plus the District of Columbia have prevailing wage laws, including Michigan—which reinstated its law in March 2023 and became effective in February 2024 (WHD, 2024; Mauger, 2023; *Fox 2 Detroit*, 2023).

Reflecting local market-based standards of compensation and craftsmanship bolsters the system of registered apprenticeship. Construction apprenticeship enrollments are 8 percent higher in states with prevailing wage laws (Bilginsoy, 2005). The result is that construction worker productivity is higher and on-the-job injuries and fatalities are lower in states with prevailing wage laws (Philips, 2014; Li et al., 2019; Manzo, Bruno, & Petrucci, 2023).

Economic research has found that prevailing wage laws create a level playing field for contractors and have no effect on overall bid competition (Ormiston & Duncan, 2022). There have been five peer-reviewed studies

since 2000 that examine the effect of prevailing wage laws on overall bid competition, and all five conclude that they do not reduce the number of bidders on public projects. This includes an examination of nearly 600 bids on public works projects in five northern California cities, an evaluation of about 500 bids on highway construction projects in Colorado, a study of nearly 700 bids on school construction projects in Ohio, an analysis of almost 300 bids on school construction projects in Nevada, an investigation of nearly 3,500 bids on state and federal highway projects in Kentucky, and a study of over 600 subcontractor bids for public schools built within the Minneapolis-St. Paul metropolitan area in Minnesota (Kim, Kuo-Liang, & Philips, 2012; Duncan, 2015; Onsarigo, Duncan & Atalah, 2020; Duncan & Waddoups, 2020; Duncan, Gigstad, & Manzo, 2022; Duncan, Case, & Manzo, 2024).

Because prevailing wage laws are associated with better trained workers, stronger workforce supply pools, improved safety outcomes, and competitive bidding, the economic consensus is that prevailing wage laws have no impact on total construction costs (Duncan & Ormiston, 2018). There have been 21 studies on the impact of prevailing wage laws on the cost of school construction, highway construction, and municipal building projects that have been published in peer-reviewed academic journals since 2000. In total, 18 of these peer-reviewed studies (86 percent) find that prevailing wage laws have no effect on total construction costs (Manzo, Bruno, & Petrucci, 2023; Duncan, Case, & Manzo, 2024).

Construction Trade Unions

Likewise, studies that suggest that project labor agreements raise public construction costs imply that wages, benefits, and standards that have been *privately negotiated* between unions and their employers in collective bargaining agreements (CBAs) negatively impact taxpayers (Bachman, Burke, & Tuerck, 2019). These reports fail to acknowledge the value of collective bargaining and unions in the construction industry, for communities, and—perhaps most importantly—for taxpayers.

Unions have long been associated with higher levels of job quality including better wages and family-supporting benefits (U.S. Treasury, 2023; BLS, 2023; Farber et al., 2021). Union membership has been found to boost a worker's lifetime earnings by $1.3 million over the course of a career (Parolin & VanHeuvelen, 2023). Across the United States in 2023, median weekly wages were $1,424 for union construction workers and $1,007 for nonunion construction workers, a 41 percent difference (BLS, 2024). Union members are much more likely to have health insurance and retirement access (BLS, 2023). Because they earn higher incomes, union construction workers contribute more in taxes and are 6 percentage points less likely to rely on government assistance programs, both of which improve public budgets for taxpayers (Manzo & Thorson, 2021; Sojourner & Pacas, 2018).

A primary reason why union construction workers build strong careers in this in-demand industry is due to the collectively bargained investments that union contractors make in family-sustaining wages, benefits, and apprenticeship training (Reed et al., 2012). Apprenticeship training is particularly important in construction (Olinsky & Ayres, 2013). Construction apprenticeship programs that are sponsored jointly by labor unions and employers (joint labor-management programs) are cooperatively administered and have standards, apprentice-to-worker ratios, and institutionalized "cents per hour" contributions negotiated with signatory contractors. By contrast, employer-only programs are sponsored by an employer or a trade association who unilaterally determines program content and monitors progress. These programs rely on voluntary contributions from contractors, who may have incentives to forgo long-term workforce development investments in order to win project bids in the short-term. Because of these different funding models, nearly all of the investment in registered apprenticeship training comes from the joint labor-management programs. Joint programs account for 75 percent of all construction apprentices across the United States, including 85 percent of women apprentices, 79 percent of Black apprentices, and 79 percent of Hispanic apprentices

(Bilginsoy et al., 2022). Joint programs train 97 percent of all construction apprentices in Illinois, 92 percent in California, and 63 percent in Oregon (Manzo & Bruno, 2020; Calamuci, 2020; Stepick & Manzo, 2021).

Registered apprenticeship programs improve safety outcomes. In a first-of-its-kind study, researchers from the Washington State Department of Labor & Industries linked apprenticeship data with plumber certification information and compared workers' compensation claims between 2000 and 2018. The researchers found that journey-level plumbers who graduated from apprenticeship programs had 31 percent lower workers' compensation claim rates than those with no apprenticeship training (Wuellner & Bonauto, 2022). Furthermore, because union worksites have better trained workers, they are much safer. An analysis of more than 37,000 Occupational Safety and Health Administration (OSHA) inspections in the construction industry in 2019 found that union worksites have 34 percent fewer violations per inspection (Manzo, Goodell & Bruno, 2021). Another study found that a 1 percent increase in unionization is associated with a 3 percent decline in the rate of occupational fatalities (Zoorob, 2018).

Union contractors invest in job quality and worker training, and these investments pay dividends in the labor market. A recent analysis of four years of survey data from the Associated General Contractors of America (AGC), including responses from 1,768 union contractors and 3,893 nonunion contractors, revealed that skilled labor shortages are much less severe in the union segment of the industry (Manzo, Petrucci, & Bruno, 2022). Union contractors are 21 percentage points less likely to experience delays in project completion times due to shortages of workers and 13 percentage points less likely to be losing their workers to other industries (Manzo, Petrucci, & Bruno, 2022). Similarly, a survey of more than 34,000 energy sector employers by the U.S. Department of Energy found that union employers have less trouble filling open positions. The union difference "was especially pronounced in the construction industry," where union contractors are 28 percentage points less likely to report that it is "very difficult" to find workers (USEER, 2023).

Economic research also shows that union workers are deliver higher levels of workforce productivity than the nonunion alternative. Valued added per employee is between 17 percent and 22 percent higher for union construction workers (Allen, 1984). Another study that compared the performance of union and nonunion contractors across 83 office buildings and 68 schools found that union productivity was at least 30 percent higher for office projects and up to 20 percent higher on school projects after accounting for differences in capital-labor ratios, labor quality, region, and building characteristics (Allen, 1986).

Studies find that, because of increases in workforce productivity, union contractors are cost-competitive on public construction projects. Two studies conducted in 2013 tested the hypotheses that unions increase taxpayer costs for school construction projects by examining more than 8,000 bids on nearly 1,500 school projects in Ohio. The studies compared bids of construction companies that contractually paid union-scale wages to those submitted by nonunion contractors and found no statistically significant difference in average bid costs per square foot (Atalah, 2013a; Atalah, 2013b). A 2020 study of nearly 300 bids on 80 school construction projects in Nevada found that union contractors were no more expensive than nonunion contractors (Duncan & Waddoups, 2020). A 2012 study of just under 600 bids on municipal construction projects in five California cities also did not find a statistically significant difference in union and nonunion bid prices (Kim, Kuo-Liang, & Philips, 2012). Furthermore, a 2024 analysis of more than 600 package bids on school construction projects in Minnesota found no cost difference between union contractors and nonunion contractors after accounting for work type (Duncan, Case, & Manzo, 2024).

Finally, a recent analysis of 1,550 industrial and commercial building projects built in the United States between 2000 and 2022 found that union construction labor is 4 percent more cost-effective (McFadden, Santosh, & Shetty, 2022). The projects ranged in size from $200,000 to more than $6 billion, with 51 percent built nonunion, 25 percent built union, and 24 percent employing a mix of union and nonunion labor. The

researchers found that union workers delivered 14 percent higher levels of productivity than the nonunion alternative, with a 33 percent lower risk of turnover and 40 percent reduction in the risk of labor shortages. The authors concluded that "union labor creates significant value for owners through lower costs and more predictable schedules," reducing overall project costs by 4 percent (McFadden, Santosh, & Shetty, 2022).

The cumulative body of economic research on prevailing wage laws and construction unions has crucial implications for project labor agreements at the Port of Seattle. Studies on prevailing wage laws and construction unions conclude that they both have no net effect on the overall costs of public construction projects. This indicates that PLAs not only had no additional impact on construction costs accounting for prevailing wage and unions, but also that the lack of any cost difference due to PLAs may be consistent in other labor markets with dissimilar policy frameworks. On the other hand, both prevailing wage laws and construction unions are linked with increased investments in apprenticeship training. If PLA projects are associated with greater usage of apprentices and more diversity on public works projects, this implies that PLAs could have meaningful effects above-and-beyond the impacts of prevailing wage and unions.

Conclusion

Project labor agreements are pre-hire agreements that establish terms and conditions of employment for all crafts and are intended to promote predictability, stability, and efficiency on large, complex construction projects. Project labor agreements also ensure that taxpayer-funded projects hire apprentices and expand opportunities into the trades for people from historically disadvantaged backgrounds. This analysis of Port of Seattle infrastructure projects since the Port Commission implemented an apprenticeship utilization policy in 2016 finds that project labor agreements are effective policy options for achieving these goals.

The four previous peer-reviewed academic studies on the cost impact of PLAs have explored between 70 public projects and 319 public projects (Figure 11). All four were focused on school construction costs, including three that evaluated elementary through secondary school projects and one that analyzed community college projects. In the one study that included an assessment of bid competition, the sample had 263 bids. This present analysis adds significantly to the economic literature by assessing the impact of PLAs on costs and bid competition for an entirely new set of public works projects: those at airport, seaport, and related facilities. While the sample size falls within the range of other studies on PLAs (95 total projects), the 366 total bids submitted is larger than any study accepted into an academic journal (Figure 11). This analysis is also the first to offer direct evidence on the impact of PLAs on apprenticeships and the hiring of apprentices who are women and people of color.

FIGURE 11: COMPARISON OF PEER-REVIEWED STUDIES ON THE PLA COST IMPACT TO THE PRESENT ANALYSIS, 2007-2024

Authors	Year	Sample Size	Type of Projects	Geography	Cost Impact
Philips & Waizman	2021	99 projects 263 bids	Community college	California	*No effect*
Waddoups & May	2014	319 projects	Public schools	Ohio	*No effect*
Belman, Ormiston, Kelso, Schriver, & Frank	2010	70 projects	Public schools	Massachusetts	*No effect*
Bachman & Haughton	2007	126 projects	Public schools	Massachusetts	9%-15%
Manzo & Bruno (this study)	**2024**	**95 projects 366 bids**	**Airport and seaport**	**Seattle, WA**	***No effect***

Source(s): Individual studies listed in the table (Philips & Waitzman, 2021; Belman et al., 2010; Waddoups & May, 2014; Bachman & Haughton, 2007).

The data reveal that project labor agreements stabilize public construction costs, ensure robust bid competition, boost apprenticeships, and expand access to construction career pathways to historically underrepresented workers. Projects with PLAs had more bidders and were slightly more likely to be awarded below the engineer's estimate than those without PLAs. After accounting for project size and complexity, the number of bids, and other important factors, PLAs had no impact on overall construction costs. Among public works projects valued at $1 million or greater, PLA projects have 5 percentage points more apprentices and are 23 percentage points more likely to achieve apprenticeship utilization goals while also being twice as likely to meet aspirational goals for hiring women apprentices.

This analysis of real-world project data from the Port of Seattle has important policy implications. The data reveal that project labor agreements have no additional effect on bid competition, costs, or cost effectiveness above-and-beyond the impacts of prevailing wage laws and construction trade unions—which do not affect public construction costs but do boost apprenticeship training, ensure job quality for skilled tradespeople, and increase tax contributions from blue-collar construction workers while reducing their reliance on government assistance programs. The results also suggest that recent efforts to expand project labor agreements—whether locally, in states across the country, or federally—are likely to have negligible impacts on contractors and taxpayers. However, the expansion of project labor agreements will increase apprenticeship training and expand opportunities to people from historically underrepresented communities at a time when the construction industry is facing a labor shortage and contractors need new workers to build, modernize, and repair trillions of dollars in American infrastructure.

Sources

Akers, Mick. (2020). "Allegiant Stadium Construction Surpasses Community Benefit Goals" *Las Vegas Review-Journal*.

Allen, Steven. (1986). "Unionization and Productivity in Office Building and Elementary and Secondary Schools." *Industrial and Labor Relations Review*, 39(2): 187-201.

Allen, Steven. (1984). "Unionized Construction Workers are More Productive." *The Quarterly Journal of Economics,* 99(2): 251-274.

Associated General Contractors of America (AGC). (2021). "Construction Workforce Shortages Reach Pre-Pandemic Levels Even as Coronavirus Continues to Impact Projects & Disrupt Supply Chains."

Atalah, Alan. (2013) (a). "Comparison of Union and Nonunion Bids on Ohio School Facilities Commission Construction Projects." *International Journal of Economics and Management Engineering*, 3(1): 29-35.

Atalah, Alan. (2013) (b). "Impact of Prevailing Wages on the Cost among the Various Construction Trades," *Journal of Civil Engineering and Architecture*, 7(4): 670-676.

Bachman, Paul, William Burke, and David Tuerck. (2019). *The Anticompetitive Effects of Government Mandated Project Labor Agreements on Construction in Washington State*. Washington Policy Center.

Bachman, Paul and Jonathan Haughton. (2007). "Do Project Labor Agreements Raise Construction Costs?" *Case Studies in Business, Industry and Government Statistics*, 1(1): 71-79.

Bachman, Paul, Jonathan Haughton, and David Tuerck. (2004). *Project Labor Agreements and the Cost of Public School Construction in Connecticut*. Beacon Hill Institute.

Bachman, Paul and David Tuerck. (2017). *Project Labor Agreements and the Cost of School Construction in Ohio*. Beacon Hill Institute.

Bachman, Paul and David Tuerck. (2006). *Project Labor Agreements and Public Construction Costs in New York State*. Beacon Hill Institute.

Belman, Dale and Matthew Bodah. (2010). *Building Better: A Look at Best Practices for the Design of Project Labor Agreements*. Economic Policy Institute; Michigan State University; University of Rhode Island.

Belman, Dale, Matthew Bodah, and Peter Philips. (2007). *Project Labor Agreements*. Michigan State University; University of Rhode Island; University of Utah; ELECTRI International.

Belman, Dale, Russell Ormiston, Richard Kelso, William Schriver, and Kenneth Frank. (2010). "Project Labor Agreements' Effect on School Construction Costs in Massachusetts." *Industrial Relations*, 49(1): 44-60.

Biden White House. (2022). "Executive Order on Use of Project Labor Agreements For Federal Construction Projects." The White House.

Bilginsoy, Cihan. (2005). "Wage Regulation and Training: The Impact of State Prevailing Wage Laws on Apprenticeship," *The Economics of Prevailing Wage Laws*. Editors: Hamid Azari-Rad, Peter Philips, and Mark Prus. 149-168.

Bilginsoy, Cihan, David Bullock, Amy Tracy Wells, and Roland Zullo. (2022). *Diversity, Equity, and Inclusion Initiatives in the Construction Trades*. Institute for Construction Economic Research; University of Utah; University of Michigan; Rutgers University.

Bivens, Josh, Lora Engdahl, Elise Gould, Teresa Kroeger, Celine McNicholas, Lawrence Mishel, Zane Mokhiber, Heidi Shierholz, Marni von Wilpert, Valerie Wilson, and Ben Zipperer. (2017). *How Today's Unions Help Working People: Giving Workers the Power to Improve Their Jobs and Unrig the Economy*. Economic Policy Institute.

Briggs, Dave. (2022). "Bally's Signs Deal With Organized Labor To Build Chicago Casino." *PlayIllinois.com*. Catena Media.

Building and Construction Trades Department (BCTD). (2012). "Are You Ready For Some Football? The NFL Says 'Yes' to Project Labor Agreements, According to The Building and Construction Trades Department." *Cision PR Newswire*.

Bureau of Labor Education (BLE). (2005). *Project Labor Agreements and Construction in Maine*. University of Maine.

Bureau of Labor Statistics (BLS). (2024). *Union Members – 2023*. U.S. Department of Labor.

Bureau of Labor Statistics (BLS). (2023). *Employee Benefits in the United States – March 2023*. U.S. Department of Labor.

Burke, William and David Tuerck. (2020). *The Effects of Project Labor Agreements on Public School Construction in Connecticut*. Beacon Hill Institute.

Burke, William and David Tuerck. (2019). *The Effects of Project Labor Agreements on Public School Construction in New Jersey*. Beacon Hill Institute.

Calamuci, Dan. (2020). *Training the Golden State: An Analysis of California Apprenticeship Programs*. Smart Cities Prevail.

Clark, John and Alexis Carpello. (2021). "Project Labor Agreement Signed for Hard Rock Casino Construction." *MyStateline.com*. WTVO.

Donald, Elizabeth. (2022). "Pritzker Makes Major Push for Workers' Rights Amendment." *Labor Tribune*.

Duncan, Kevin. (2015). "The Effect of Federal Davis-Bacon and Disadvantaged Business Enterprise Regulations on Highway Maintenance Costs." *Industrial and Labor Relations Review*, 68(1): 212-237.

Duncan, Kevin and Russell Ormiston. (2018). "What Does the Research Tell Us About Prevailing Wage Laws?" *Labor Studies Journal*, 44(2): 139-160.

Duncan, Kevin and Jeffrey Waddoups. (2020). "Unintended Consequences of Nevada's Ninety-Percent Prevailing Wage Rule." *Labor Studies Journal*, 45(2): 166-185.

Duncan, Kevin, Adam Case, and Frank Manzo IV. (2024). "Prevailing Wages, School Construction Costs, and Bids by Out-of-State Contractors: Evidence from the Minneapolis–Saint Paul Metropolitan Area." *Construction Management and Economics*. Published Online February 20, 2024.

Duncan, Kevin, Jill Gigstad, and Frank Manzo IV. (2022). "Prevailing Wage Repeal, Highway Construction Costs, and Bid Competition in Kentucky: A Difference-in-Differences and Fixed Effects Analysis." *Public Works Management & Policy*. OnlineFirst.

Executive Order (EO) 19-2. (2019). "Executive Order Strengthening Working Families." Governor of Illinois JB Pritzker.

Farber, Henry, Daniel Herbst, Ilyana Kuziemko, and Suresh Naidu. (2021). "*Unions and Inequality Over the Twentieth Century: New Evidence from Survey Data*." *The Quarterly Journal of Economics*, 136(3): 1,325-1,385.

Figueroa, Maria, Jeffrey Grabelsky, and Ryan Lamare. (2011). *Community Workforce Provisions in Project Labor Agreements: A Tool for Building Middle-Class Careers*. Cornell University.

Fox 2 Detroit. (2023). "New Laws Taking Effect in Michigan in 2024."

Glass, Aurelia, David Madland, and Christian Weller. (2021). *Unions Help Increase Wealth for All and Close Racial Wealth Gaps*. Center for American Progress.

Glass, Aurelia and Karla Walter. (2023). *How Project Labor Agreements and Community Workforce Agreements Are Good for the Biden Administration's Investment Agenda*. Center for American Progress.

Hill International. (2011). *Implementation of Project Labor Agreements in Federal Construction Projects: An Evaluation*. Submitted to the U.S. Department of Labor.

Kim, Jaewhan; Chang Kuo-Liang; and Peter Philips. (2012). "The Effect of Prevailing Wage Regulations on Contractor Bid Participation and Behavior: A Comparison of Palo Alto, California with Four Nearby Prevailing Wage Municipalities." *Industrial Relations*, 51(4): 874-891.

Kotler, Fred. (2011). *Project Labor Agreements in New York State II: In the Public Interest and of Proven Value*. Cornell University.

Labor & Industries (LNI). (2024). "How Prevailing Wage Rates are Developed." Washington State Department of Labor & Industries.

Labor & Industries (LNI). (2020). *The Washington State Prevailing Wage Law*. Washington State Department of Labor & Industries.

Li, Zhi, Chimedlkham Zorigtbaatar, Grbiel Pleités, Ari Fenn, and Peter Philips. (2019). "The Effect of Prevailing Wage Law Repeals and Enactments on Injuries and Disabilities in the Construction Industry." *Public Works Management & Policy*, 24(4): 1-17.

Long, George. (2013). *Differences Between Union and Nonunion Compensation, 2001-2011*. Bureau of Labor Statistics at the U.S. Department of Labor.

Manzo IV, Frank and Robert Bruno. (2020). *The Apprenticeship Alternative: Enrollment, Completion Rates, and Earnings in Registered Apprenticeship Programs in Illinois*. Illinois Economic Policy Institute; University of Illinois at Urbana-Champaign.

Manzo IV, Frank and Robert Bruno. (2015). *Efficiencies of Project Labor Agreements: Illinois Capital Development Board Projects, 2011-2013*. Illinois Economic Policy Institute; University of Illinois at Urbana-Champaign.

Manzo IV, Frank and Kevin Duncan. (2018). *An Examination of Minnesota's Prevailing Wage Law: Effects on Costs, Training, and Economic Development*. Midwest Economic Policy Institute; Colorado State University-Pueblo.

Manzo IV, Frank and Erik Thorson. (2021). *Union Apprenticeships: The Bachelor's Degrees of the Construction Industry – Data for the United States, 2010-2020*. Illinois Economic Policy Institute.

Manzo IV, Frank, Robert Bruno, and Larissa Petrucci. (2023). *The Economic Impact of Prevailing Wage Law Repeals on Construction Market Outcomes: Evidence from Repeals Between 2015 and 2018*. Illinois Economic Policy Institute; University of Illinois at Urbana-Champaign.

Manzo IV, Frank, Nathaniel Goodell, and Robert Bruno. (2021). (a) *The Impact of Unions on Construction Worksite Health and Safety: Evidence from OSHA Inspections*. Illinois Economic Policy Institute; University of Illinois at Urbana-Champaign.

Manzo IV, Frank, Jill Gigstad, Robert Bruno, and Kevin Duncan. (2021). (b). *Building a Strong Minnesota: An Analysis of Minnesota's Union Construction Industry*. Midwest Economic Policy Institute; University of Illinois at Urbana-Champaign; Colorado State University-Pueblo.

Manzo IV, Frank, Larissa Petrucci, and Robert Bruno. (2022). *The Union Advantage During the Construction Labor Shortage: Evidence from Surveys of Associated General Contractors of America Member Firms*. Illinois Economic Policy Institute; University of Illinois at Urbana-Champaign.

Mauger, Craig. (2023). "Gov. Whitmer Signs Bills to Repeal Right to Work, Restore Prevailing Wage." *The Detroit News*.

Mayer, Gerald. (2010). *Project Labor Agreements*. Congressional Research Service.

McFadden, Michael, Sal Santosh, and Ronit Shetty. (2022). *Quantifying the Value of Union Labor in Construction Projects*. Independent Project Analysis.

McFarland, Pam. (2022). "Federal Labor Proposal Flares Union, Industry Tensions." *Engineering News-Record*.

Minnesota Multi-Purpose Stadium (MMPS). (2013). *Project Labor Agreement for Minnesota Multi-Purpose Stadium*. Signed November 22, 2013.

Moran, John. (2011). *Pros and Cons of Using Project Labor Agreements*. Office of Legislative Research at the Connecticut General Assembly.

New York State Energy Research and Development Authority (NYSERDA). (2019). *Fact Sheet: Offshore Wind Contracts and Phase One Report*. New York State.

North America's Building Trades Unions (NABTU). (2023). *Comments of North America's Building Trades Unions on the Office of Management and Budget's Proposal to Revise Guidance for Grants and Agreements*. Regulations.gov.

Obama White House. (2009). "Use of Project Labor Agreements for Federal Construction Projects." White House Archives.

Olinsky, Ben and Sarah Ayres. (2013). *Training for Success: A Policy to Expand Apprenticeships in the United States*. Center for American Progress.

Onsarigo, Lameck, Kevin Duncan, and Alan Atalah. (2020). "The Effect of Prevailing Wages on Building Costs, Bid Competition, and Bidder Behavior: Evidence from Ohio School Construction." *Construction Management and Economics*, 38(10): 1-17.

Ormiston, Russell and Kevin Duncan. (2022). *Project Labor Agreements: A Research Review*. Institute for Construction Economic Research; Allegheny College; Colorado State University-Pueblo.

Parolin, Zachary and Tom VanHeuvelen. (2023). "The Cumulative Advantage of a Unionized Career for Lifetime Earnings." *ILR Review*, 76(2): 434–460.

Petrucci, Larissa, Grace Dunn, and Matthew Hinkel. (2023). *The Effect of Project Labor Agreements on Completion Timeliness for Public Works Construction in California*. NorCal Construction Industry Compliance; Illinois Economic Policy Institute; Alma College.

Philips, Peter. (2014). *Kentucky's Prevailing Wage Law: An Economic Impact Analysis*. University of Utah.

Philips, Peter and Scott Littlehale. (2015). *Did PLAs on LA Affordable Housing Projects Raise Construction Costs?* University of Utah.

Philips, Peter and Emma Waitzman. (2021). "Do Project Labor Agreements Reduce the Number of Bidders on Public Projects? The Case of Community Colleges in California." *Public Works Management and Policy*, 26(4): 337-358.

Port of Seattle. (2024). (a). "Project Labor Agreement."

Port of Seattle. (2024). (b). "Current and Past Solicitations" Dashboard.

Port of Seattle. (2024). (c). "Labor Relations."

Port of Seattle. (2024). (d). "Solicitations Index – Solicitation Detail: 2020 Airfield Pavement Replacement."

Port of Seattle. (2023). (a). *2023 Budget in Brief*.

Port of Seattle. (2023). (b). *Apprenticeship and Priority Hire: Connecting Underserved Communities, Port-funded Apprenticeship and Priority Hire (Construction Apprenticeship and Priority Hire 2022 Annual Report)*.

Port of Seattle. (2022). *Apprenticeship and Priority Hire: 2021 Annual Report*.

Port of Seattle. (2021). *Apprenticeship and Priority Hire: 2020 Annual Report*.

Port of Seattle. (2019). "Resolution No. 3725, as Amended." Adopted October 2016 and amended April 2018.

Port of Seattle. (2018). *Port of Seattle Commission Policy Directive on Construction Labor Practices for Projects Located on Port of Seattle Property: As Amended April 24, 2018*.

Reed, Debbie, Albert Yung-Hsu Liu, Rebecca Kleinman, Annalisa Mastri, Davin Reed, Samina Sattar, and Jessica Ziegler. (2012). *An Effectiveness Assessment and Cost-Benefit Analysis of Registered Apprenticeship in 10 States*. Mathematica Policy Research. Submitted to the U.S. Department of Labor Employment and Training Administration (DOLETA).

Schmitt, John. (2008). *The Union Wage Advantage for Low-Wage Workers*. Center for Economic and Policy Research.

Seattle Finance & Administrative Services (FAS). (2022). *2021 Priority Hire Annual Report*. City of Seattle.

Slowey, Kim and Mary Tyler March. (2018). "Financing, Procedures Documents Approved for $2B Las Vegas Raiders Stadium." *Construction Dive*.

Sojourner, Aaron and Jose Pacas. (2018). *The Relationship between Union Membership and Net Fiscal Impact*. University of Minnesota; Institute of Labor Economics

Stepick, Lina and Frank Manzo IV. (2021). *The Impact of Oregon's Prevailing Wage Rate Law: Effects on Costs, Training, and Economic Development*. University of Oregon; Illinois Economic Policy Institute.

Swanek, Thaddeus. (2021). "Many U.S. Construction Contractors are Turning Down Work Because They Don't Have Enough Workers." U.S. Chamber of Commerce.

Tennessee Valley Authority (TVA). (2020). "TVA Announces Historic Extension of Labor Agreement."

United States Treasury. (2023). *Labor Unions and the Middle Class*. U.S. Department of the Treasury.

US Bank Stadium. (2023). "History." Minnesota Sports Facilities Authority.

United States Department of Labor (USDOL). (2024). *Project Labor Agreement Resource Guide*. Good Jobs Initiative.

USEER. (2023). *United States Energy & Employment Report 2023*. U.S. Department of Energy.

Waddoups, Jeffrey C. and David May. (2014). "Do Responsible Contractor Policies Increase Construction Bid Costs?" *Industrial Relations*, 53(2): 273-294.

Wage and Hour Division (WHD). (2024). "Dollar Threshold Amount for Contract Coverage." U.S. Department of Labor.

Waheed, Saba and Lucero Herrera. (2014). *Exploring Targeted Hire: An Assessment of Best Practices in the Construction Industry*. University of California, Los Angeles.

Waitzman, Emma and Peter Philips. (2017). *Project Labor Agreements and Bidding Outcomes: The Case of Community College Construction in California*. University of California, Berkeley; University of Utah.

Walters, Matthew and Lawrence Mishel. (2003). *How Unions Help All Workers*. Economic Policy Institute.

Ward, Jason. (2021). *The Effects of Project Labor Agreements on the Production of Affordable Housing: Evidence from Proposition HHH*. RAND Corporation.

Wuellner, Sara and David Bonauto. (2022). "Are Plumbing Apprentice Graduates Safer than Their Non-Apprentice Peers? Workers' Compensation Claims Among Journey Level Plumbers by Apprenticeship Participation." *Journal of Safety Research*, 83: 349-356.

Zoorob, Michael. (2018). "Does 'Right to Work' Imperil the Right to Health? The Effect of Labour Unions on Workplace Fatalities." *Occupational and Environmental Medicine*, 75(10): 736-738.

Cover Photo Credits

A330Pilot. "Road Construction." (Accessed January 15, 2024). *Canva.com Pro Account*.

Fan, Shunyu. "Port of Seattle, Washington Sunset." (Accessed January 15, 2024). *Canva.com Pro Account*.

Johnson, David. "Port of Seattle." (Accessed January 15, 2024). *Canva.com Pro Account*.

SweetbabeeJay. "Construction Crane in Seattle Washington." (Accessed January 15, 2024). *Canva.com Pro Account*.