A

Kate Harrison
Councilmember, District 4

ACTION CALENDAR
December 5, 2023
(Continued from November 28, 2023)

To: Honorable Mayor and Members of the City Council

From: Councilmember Harrison

Subject: Refer to the City Manager to Enhance the City's Deconstruction and Construction Materials Management Enforcement and Regulations and Refer to the AAO #1 Budget Process $250,000 for Social Cost of Carbon Nexus Fee Study for Berkeley Origin Construction and Demolition Debris

RECOMMENDATION

1. Refer to the City Manager to review and develop enhanced and enforceable City deconstruction and materials management regulations, including the following elements:

a. Review of national and international best practices for regulating deconstruction, diversion, recycling, and reuse of construction and demolition materials;
b. Integrate deconstruction and construction and enhanced demolition debris management, tracking, and regulation into the Department of Public Works' Zero Waste Strategic Plan and Transfer Station upgrade as appropriate;
c. Policy options for (1) enforcing minimum State diversion and recycling requirements, (2) new deconstruction requirements applicable to all permitted Berkeley projects including defining specific building components that are potentially reusable and requiring an enforceable salvage survey provided by the City, a reuse organization, or other third party approved by the City, (3) potentially implementing a social cost of carbon fee on construction and demolition debris, (4) possible enhancements to minimum statewide diversion goals, (5) comprehensive tracking of the disposition of construction and demolition materials, (6) enhancing diversion from un-permitted projects, and (7) integrating salvageable material into developer project planning and budgeting process and permit application plan set (as opposed to at time of final permitting).
d. Background survey on contents of existing building stock to get more data on intended impact and opportunities regarding new deconstruction requirements; vetting of existing service providers (certified salvage contractors and salvage material vendors), markets for salvage materials, a list of approved reuse/salvage facilities; a plan for educating contractors on requirements; and an analysis of the costs of compliance with and implementation of any proposed regulations and analysis of any corresponding impacts on feasibility of new construction.

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2. Refer to December 2023 Budget AAO #1 Process $250,000 to conduct a nexus fee study (using the latest academic research, updated damage functions, and low discount rates)[1] for a potential social cost of carbon fee to be applied e.g., to the impact of displacing existing embodied carbon (landfilled construction and demolition debris) and replacement with new embodied carbon. The purpose of the fee is to incentivize reuse and deconstruction, minimize demolition, maximize useful embodied carbon, and fund the City's ongoing green building work and services.

POLICY COMMITTEE RECOMMENDATION

On November 1, 2023, the Facilities, Infrastructure, Transportation, Environment & Sustainability Committee adopted the following action:

M/S/C (Robinson/Harrison) to refer the revised agenda material with a positive recommendation to Council with the following revisions to the recommendation:

1. Section C.3 to read as follows: "potentially implementing a social cost of carbon fee on construction and demolition debris."
2. Section D to read as follows: "Background survey on contents of existing building stock to get more data on intended impact and opportunities regarding new deconstruction requirements; vetting of existing service providers (certified salvage contractors and salvage material vendors), markets for salvage materials, a list of approved reuse/salvage facilities; and a plan for educating contractors on requirements; and an analysis of the costs of compliance with and implementation of any proposed regulations and analysis of any corresponding impacts on feasibility of new construction."

Vote: Ayes – Robinson, Harrison; Noes – None; Abstain – Humbert; Absent –None.

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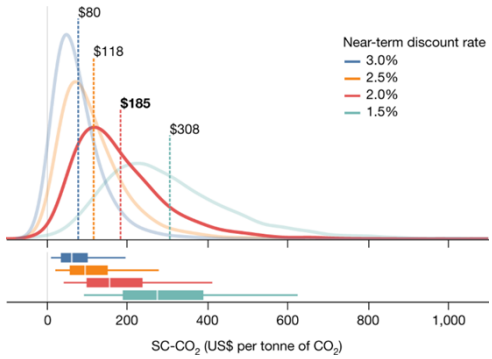
[1] See Rennert, K., Errickson, F., Prest, B.C. *et al.* Comprehensive evidence implies a higher social cost of CO_2. *Nature* **610**, 687–692 (2022). https://doi.org/10.1038/s41586-022-05224-9. Using a 1.5% discount rate, the social cost of carbon in 2020 dollars is estimated at $308 (~$367.48 in 2023) per metric ton of carbon dioxide:



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CURRENT SITUATION, EFFECTS, AND RATIONALE FOR RECOMMENDATION

The accumulation, collection, removal and disposal of waste associated with construction, deconstruction and demolition activities needs to be regulated for the protection of the public health, safety and welfare, climate and natural environment.

According to the World Green Building Council, 11% of all energy-related carbon emissions result from building materials and construction activities.[2] These emissions are often referred to as "embodied carbon," which the International Code Council defines "the carbon emissions released during the extraction, manufacturing, transportation, construction and end-of-life phases of buildings."[3]

Emissions are not only embodied in new construction materials and activities, but also in those of the past. The current built environment represents the physical manifestation of past greenhouse gas emissions (GHGs), and given the imperative of rapidly reducing GHGs, such material must be prioritized for preservation, or reuse. Every part of the built environment, whether constructed with ancient redwood timber in the nineteenth century or Canadian Douglas fir and pine in the twenty-first, must be considered and valued within the context of cumulative historic emissions and dwindling and nearly expired carbon budgets.

State law imperfectly addresses the end-of-life phases of buildings through the California Integrated Waste Management Act of 1989 and the California Green Building Code, which requires local governments to require fifty percent of construction debris be diverted from the landfill. Senate Bill 1374 further requires annual reporting to the state on progress made in the diversion of construction related materials, including information on programs and ordinances implemented and quantitative data, where available. In 2016, of Berkeley's total waste stream, 10% was from construction and demolition materials. As discussed below, this number is now likely much higher given the recent uptick in construction.

Additional required minimum diversion rates by project type are covered under the California Green Building Code and the City's local amendments in BMC Title 19 (2019), Buildings and Construction. As a minimum, the latest State code requires 65% of non-hazardous construction and demolition (C&D) waste to be reused *or* recycled. In addition, the State also requires recycling or reuse of 100% of excavated soil and land-

[2] "Bringing Embodied Carbon Upfront." World Green Building Council, 25 Jan. 2023, https://worldgbc.org/article/bringing-embodied-carbon-upfront/.
[3] "Embodied Carbon." ICC, 11 May 2021, https://www.iccsafe.org/advocacy/embodied-carbon/.

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clearing debris, concrete, and asphalt. Current requirements include a "Construction Waste Management Plan" survey and requirement to provide receipts of recycled and salvaged material. City Zero Waste staff indicated that while the City tracks diversion, they currently do not eforce State requirements.

Existing laws fall short because there is no state or local requirement that requires property owners or developers to work with the City to develop an accountable plan to carefully take apart a building to maximize reusable materials, whether onsite or through a salvaging operation. In addition, recycling, an allowed alternative to reuse of demolition materials may not maximize capturing embodied carbon. For example, State law includes loopholes that allow a certain percentage of demolition materials to be 'recycled' as a cover to layers of trash in landfills.

This referral to the City Manager aims to implement best practice methods for separation, handling, and delivery of deconstruction and construction site materials to maximize the salvage of building materials for reuse, to reduce the amount of construction and demolition-related materials disposed in landfills and to establish deconstruction and source separation requirements. It also would fund an innovative nexus study to charge a possible social cost of carbon fee on construction and demolition debris to incentivize reuse and deconstruction, minimize demolition, maximize useful embodied carbon, and fund the City's ongoing green building work and services.

Other jurisdictions, such as Palo Alto and Portland, have already implemented deconstruction ordinances. To protect public health, safety and welfare, climate and natural environment, it is in the public interest to adopt this referral and budget referral.

BACKGROUND

In 2021, the World Green Building Council warned that by 2050 "the [global] building stock is expected to double in size. Carbon emissions released before the built asset is used, referred to as 'upfront carbon', will be responsible for half of the entire carbon footprint of new construction between now and 2050, threatening to consume a large part of our remaining carbon budget."[4] Viewed over the next 10 years, the window scientists view as critical to limiting catastrophic warming emissions, new embodied carbon represents a significant 72% of total building sector emissions.[5] Much of these

[4] "Bringing Embodied Carbon Upfront."

[5] Logan, Katharine. "Continuing Education: Embodied Carbon & Adaptive Reuse." Architectural Record RSS, Architectural Record, 25 May 2022, https://www.architecturalrecord.com/articles/15481-continuing-education-embodied-carbon-adaptive-reuse.

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emissions include those associated with the demolition of existing buildings and the new buildings that replace them.

Buildings Magazine, a trade magazine for facility managers and owners of commercial and public buildings, estimates that already an astounding 30% of all waste in the United States is construction and demolition waste. New construction is associated with an average of 3.9 pounds of waste per square foot while demolition yields an astounding 155 pounds of waste per square foot.[6]

When a building is haphazardly demolished to make way for new construction, not only are carbon emissions typically expended to tear it down and transport it for waste processing and disposal, but the former building, composed of many tons of carbon emissions and products arranged in a form useful to society, is rendered useless as waste, or much less useful to society as recyclable material. Instead, the builder replaces the demolished structure with new embodied carbon in constructing the new building, which generates new waste and additional emissions.

According to a 2011 study, even assuming a 30% increase in efficiency resulting from a newly constructed building, it takes 10 to 80 years for the newer and more efficiently operating building to 'break even' or offset the negative carbon impacts associated with replacing an average-performing existing building (not accounting for the "lost" carbon originally embodied in the original building).[7] The following figure demonstrates the number of years required in Portland and Chicago for various forms of newly constructed efficient buildings replacing demolished inefficient buildings to 'break even' with or 'overcome' the new emissions associated with new construction (note: this figure does not include embodied emissions wasted as part of the original construction):

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[6] Monroe, Linda. Diverting Construction Waste | Buildings. https://www.buildings.com/department/article/10192921/diverting-construction-waste; See also, Sahabi, Ali. "Structural Retrofits Reduce the Carbon Footprint (Part 2 of 3) - USGBC-La." USGBC, 25 Feb. 2023, https://usgbc-la.org/2023/02/09/structural-retrofits-reduce-the-carbon-footprint-part-2-of-3.

[7] "National Trust for Historic Places: Return to Home Page." The Greenest Building: Quantifying the Environmental Value of Building Reuse, Preservation Green Lab of the National Trust for Historic Preservation, 2011, https://forum.savingplaces.org/connect/community-home/librarydocuments/viewdocument?DocumentKey=227592d3-53e7-4388-8a73-c2861f1070d8&CommunityKey=00000000-0000-0000-0000-000000000000&tab=librarydocuments, p. VIII.

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Year Of Carbon Equivalency For Existing Building Reuse Versus New Construction

This study finds that it takes between 10 to 80 years for a new building that is 30 percent more efficient than an average-performing existing building to overcome, through efficient operations, the negative climate change impacts related to the construction process. This table illustrates the numbers of years required for new, energy efficient new buildings to overcome impacts.

Building Type	Chicago	Portland
Urban Village Mixed Use	42 years	80 years
Single-Family Residential	38 years	50 years
Commercial Office	25 years	42 years
Warehouse-to-Office Conversion	12 years	19 years
Multifamily Residential	16 years	20 years
Elementary School	10 years	16 years
Warehouse-to-Residential Conversion*	Never	Never

*The warehouse-to-multifamily conversion (which operates at an average level of efficiency) does not offer a climate change impact savings compared to new construction that is 30 percent more efficient. These results are driven by the amount and kind of materials used in this particular building conversion. As evidenced by the study's summary of results, as shown on page VII, the warehouse-to-residential conversion does offer a climate change advantage when energy performance for the new and existing building scenarios are assumed to be the same. This suggests that it may be especially important to retrofit warehouse buildings for improved energy performance, and that care should be taken to select materials that will maximize environmental savings.

[8]

Since 2011, the advent of new insulation and electrification technologies make renovating or adapting older buildings more competitive in terms of reducing existing onsite carbon emissions.[9] This referral takes the perspective that both the carbon avoided by reusing existing materials (as in the examples above) and the carbon used in the original construction need to be considered as impacts of C&D and be accounted for in addressing the climate emergency. In other words, existing buildings represent historic expenditures of carbon and demolition needs to be seen as both destroying the usefulness of past emissions and *contributing new emissions*.

The greenest building is the one that already exists.[10] The best way to avoid new carbon emissions, and to repurpose or restore the use value of existing emissions, is to

[8] Id.
[9] Id., p. 20
[10] Adam, Robert. "'The Greenest Building Is the One That Already Exists.'" The Architects' Journal, 13 Aug. 2021, https://www.architectsjournal.co.uk/news/opinion/the-greenest-building-is-the-one-that-already-exists.

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preserve and renovate existing structures. To the extent that new or additional uses are needed, e.g., converting a single-family home into a multiplex, the lowest carbon path is to maintain as much of the original structure as possible with expansions and modifications as needed. Such a strategy maintains the integrity of the historic embodied carbon, and minimizes expenditure of new carbon emissions. For example, UC Berkeley's new Engineering Center includes adaptive reuse which UC states "will significantly lower the carbon emissions of the project, including more than a 90% reduction in demolition."[11]

A 2021 study conducted by ECONorthwest found that "conservatively speaking, residential and commercial demolitions in the City of Portland are responsible for 124,741 metric tons of CO_2 emissions per year, which amounts to approximately 4.5 percent of the City's total annual [emissions] reduction goal."[12]

[11] "Engineering Center." *Berkeley Engineering*, 2 May 2023, engineering.berkeley.edu/about/facilities/engineering-center/.

[12] Oregon, Restore. "Understanding the Carbon Cost of Demolition." Restore Oregon, 1 Oct. 2021, https://restoreoregon.org/2021/04/12/understanding-the-carbon-cost-of-demolition/.

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City of Berkeley's Current Construction and Demolition Waste

A 2017 StopWaste Waste Characterization Study for Alameda County found that approximately 10% of Berkeley's total waste tonnage in 2016 resulted from C&D debris.[14]

2017 Waste Characterization Study Design
StopWaste of Alameda County, CA

SCS ENGINEERS

Exhibit 2. 2016 Annual Waste Quantities – Adjusted

Originating Jurisdiction	MSW						C&D			Special				Unknown	Total
	Davis Street TS	Berkeley TS	BLT Ent TS	Altamont LF	Vasco Rd LF	TOTAL	Davis Street TS	Altamont LF	TOTAL	Davis Street TS	Altamont LF	Vasco Rd LF	TOTAL	Vasco Rd LF	
Alameda	23,417	36			344	23,796	1,283	135	1,418		355	14	369		25,583
Albany	3,567	364			2	3,933	1,023		1,023		0		0		4,956
Berkeley	2,091	47,014		171	76	49,352	5,269	5	5,274		432	11	443		55,069
Castro Valley SD	INCLUDED IN Alameda Unincorporated														
Dublin	51			28,591	1,602	30,244	25	41	66		97	60	158		30,468
Emeryville	5,873	166			16	6,056	3,051		3,051		349	2	351		9,457
Fremont	417		156,167	2	918	157,503	229	127	356		305	347	652		158,510
Hayward	78,374	233	7	104	1,341	80,058	20,320	190	20,510	290	1,915	264	2,468		103,036
Livermore	100			284	58,923	59,307	88	2,063	2,151		562	601	1,163		62,621
Newark	69		28,946	0	39	29,054	34	2	36		0	225	225		29,315
Oakland	148,509	7,635		76	3,451	159,671	21,664	242	21,905		7,430	434	7,864		189,441
Oro Loma SD	INCLUDED IN Alameda Unincorporated														
Piedmont	39	135			9	183	69		69		17		17		269
Pleasanton	158			8	94,690	94,856	297	985	1,282		203	403	606		96,744
San Leandro	31,752	213		50	39,003	71,018	5,513	10	5,523	4,231	375	389	4,994		81,535
Unincorporated	25,713	175		756	3,236	29,879	3,471	185	3,656	358	1,164	181	1,703	262	35,499
Union City	791		34,342	2	69	35,204	74	2	76		399	2,318	2,717		37,998
Total	**320,920**	**55,971**	**219,462**	**30,043**	**203,719**	**830,114**	**62,411**	**3,986**	**66,397**	**4,879**	**13,602**	**5,250**	**23,731**	**262**	**920,503**

1. Removed 4,000 tons of Special Waste disposed at at Altamont Landfill from City of Alameda
2. Removed 18,800 tons of MSW disposed of at Berkeley TS from City of Berkeley
3. Removed 20,662 tons o f MSW disposed of at Altamont LF from City of Newark; and removed 27,357 tons of Special Waste disposed of at Altamont LF from City of Newark

[15]

This study predates the recent building boom associated with new local and statewide housing policies, economic developments, and COVID-19 related renovation trends. It may also not capture cross-jurisdictional disposal of waste.

A snapshot for the twelve months preceding April, 2023 suggests a substantial increase in C&D as compared to StopWaste's 2016 study. As reported through the City's Green Halo Systems dashboard, C&D waste was more than 18,000 tons, a staggering 244% increase from 2016 levels. Of this material, the City reported that only 567 tons were

[13] Id.

[14] "Alameda County 2017-18 Waste Characterization Study." StopWaste - A Public Agency Reducing Waste in Alameda County, StopWaste, 5 Sept. 2018, https://www.stopwaste.org/resource/alameda-county-2017-18-waste-characterization-study.

[15] Id.

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reused while 2,530 tons were disposed (landfill), and 15,073 recycled.[16] The distribution of materials within each distinct material category is not clear. The Green Halo dashboard summarizes overall C&D by category over the same period as follows:

	MATERIAL	IN TONS	RATE
1	Concrete	10,839.63	58.74%
2	Mixed C & D Debris	4,762.22	25.80%
3	Asphalt - Pavement & Grinding	661.01	3.58%
4	Deconstructed & Reuse Items	567.24	3.07%
5	Bricks, Masonry & Stone Products	474.15	2.57%
6	Dirt/Soil-Clean Fill	320.97	1.74%
7	Metal	286.43	1.55%
8	Waste (Trash)	207.81	1.13%
9	Drywall - Clean/Unpainted	198.87	1.08%
10	Wood - Clean	136.52	0.74%

[17]

The author worked with Zero Waste staff to produce a snapshot of construction and demolition debris from Berkeley origin permitted, and non-Berkeley origin and unpermitted Berkeley origin projects for 2022:

[16] City of Berkeley Recycling Center, City of Berkeley, Powered by Green Halo Systems and City of Berkeley, 5 Apr. 2023, https://berkeley.wastetracking.com/.
[17] Id.

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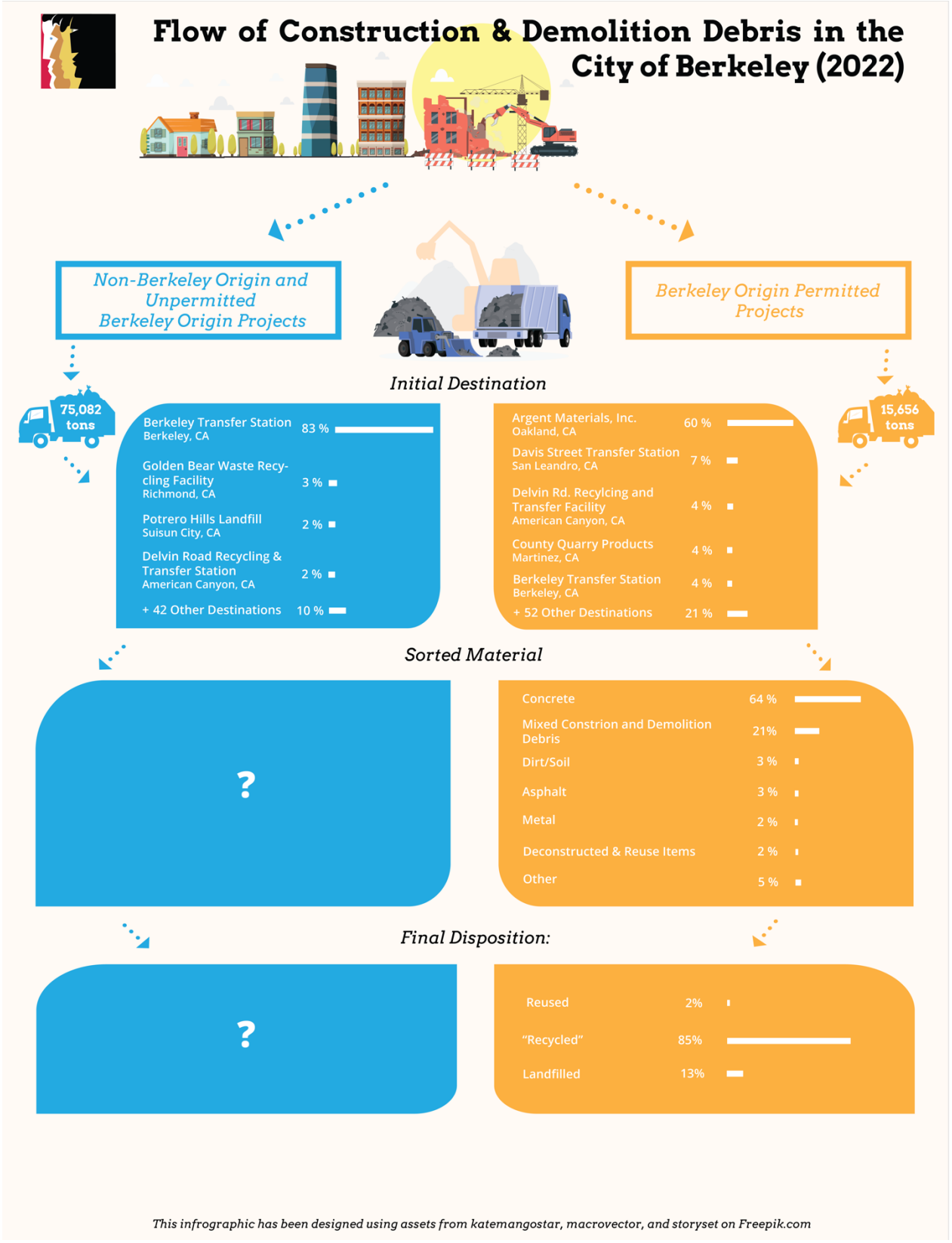
Refer to the City Manager to Enhance the City's Deconstruction and Construction Materials Management Enforcement and Regulations and Refer to the AAO #1 Budget Process $250,000 for Social Cost of Carbon Nexus Fee Study for Berkeley Origin Construction and Demolition Debris

ACTION CALENDAR
December 5, 2023

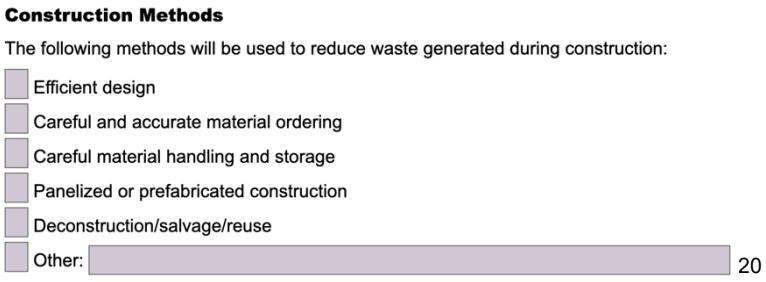


City of Berkeley's Current Approach to C&D Waste

In furtherance of state law regulating C&D debris,[18] the Building and Safety Permit Service Center currently maintain a "Construction Waste Management Plan"[19] form applicable to the following projects:

1. Any non-residential projects requiring building permits.
2. Residential new buildings.
3. Residential projects that increase a building's conditioned area, volume, or size.
4. Residential projects valued over $100,000.
5. Demolition permits valued over $3,000.

Projects are asked to disclose generally which methods they intend to use to reduce waste during construction:



Construction Methods

The following methods will be used to reduce waste generated during construction:

- ☐ Efficient design
- ☐ Careful and accurate material ordering
- ☐ Careful material handling and storage
- ☐ Panelized or prefabricated construction
- ☐ Deconstruction/salvage/reuse
- ☐ Other: [20]

Applicants then complete a more detailed "Construction Waste Management Plan" through the Green Halo web platform.

In addition, the form asks for information about weight tickets for disposed and recycled materials and photos of any salvaged/reused materials. This data is then uploaded and processed via the City's Green Halo dashboard.

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[18] A minimum of 65% of the waste generated by construction and demolition activities must be diverted away from landfill disposal through any combination of recycling, salvage, reuse or composting. 100% of asphalt, concrete, and land clearing debris must be recycled.

[19] Form #172 Construction Waste Management Plan - Berkeley, California. Building and Safety Permit Service Center, 19 Mar. 2021, https://berkeleyca.gov/sites/default/files/2022-02/Waste%20Management%20Plan.pdf.

[20] Id.

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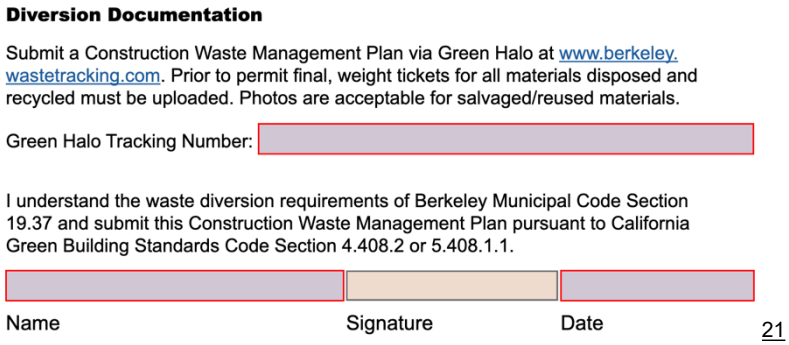

Diversion Documentation

Submit a Construction Waste Management Plan via Green Halo at www.berkeley.wastetracking.com. Prior to permit final, weight tickets for all materials disposed and recycled must be uploaded. Photos are acceptable for salvaged/reused materials.

Green Halo Tracking Number:

I understand the waste diversion requirements of Berkeley Municipal Code Section 19.37 and submit this Construction Waste Management Plan pursuant to California Green Building Standards Code Section 4.408.2 or 5.408.1.1.

Name Signature Date

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Referral Overview: Enforcement and Consideration of New Requirements

Drawing inspiration from neighboring jurisdictions such as Palo Alto and Portland, the proposed referral to the City Manager moves beyond the state's simple percentage-based diversion, recycling, and reuse requirements, and towards defining specific building components that are potentially reusable and requiring a salvage survey provided by the City, a reuse organization, or other third party approved by the City. These reporting requirements would need to be met prior to the issuance of a demolition permit. The survey is aimed at itemizing the potential materials and items eligible for salvage and reuse and the estimated weights, preparing the builder for source separation, and connecting builders directly to salvaging experts who may be able to connect the builder to organizations who can accept or purchase their material for reuse. The threshhold would remain the same as in the current statute.

This approach is more proactive than state rules, which rely on the judgment of the builder, to avoid incentivizing (1) more destructive techniques of traditional demolition, and (2) recycling instead of reuse. In addition, the City now only requires the builder to self-certify that disposed material was diverted after demolition occurs (as opposed to a detailed site survey that estimates weights before demolition occurs).

The referral also requires deconstruction, which is defined as "the systematic and careful dismantling of a structure, typically in the opposite order it was constructed, in order to maximize the salvage of materials and parts for reuse and recycling."

Upon completion of the deconstruction and source separation of materials, the applicant or person responsible for the project may be required to ensure the items listed on the salvage survey are delivered to, collected by or received by, and certified by a reuse

[21] Id.

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organization or other third party approved by the City, and shall submit to the City proof of delivery of salvage items in accordance with City regulations. This process creates a chain of custody of environmentally, labor, and carbon intensive resources, and incentivizes builders to prioritize designs and projects that minimize demolition in favor of adaptation.

In addition, this item includes a referral to the City Manager to conduct a nexus fee study in connection with a potential social cost of carbon fee applied to landfilled construction and demolition debris. The City Attorney's office has advised that the nexus study must be completed before the Council can consider a fee.

FISCAL IMPLICATIONS

Staff time will be needed to implement the referrals.

ENVIRONMENTAL SUSTAINABILITY

Restoring or adapting embodied carbon in buildings is significantly less carbon intensive than demolition and new construction. In instances where restoration and adaptation are not feasible, reuse of materials through deconstruction is superior to traditional demolition techniques.

CONTACT PERSON

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