

CONSTRUCTION & DEMOLITION WASTE MANUAL

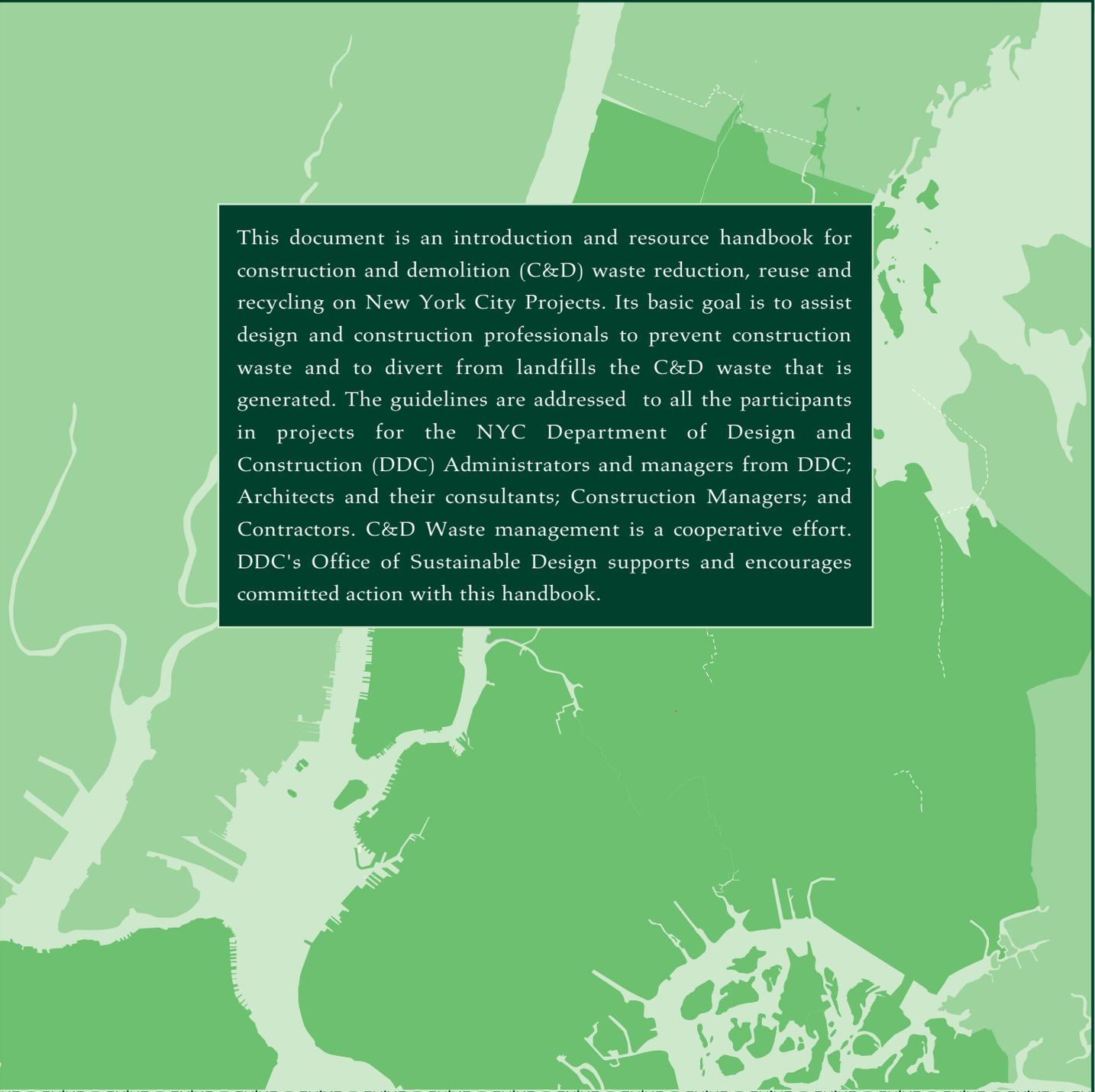


City of New York
DCC

Department of Design and Construction

Prepared for
NYC Department of Design & Construction by
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May 2003



This document is an introduction and resource handbook for construction and demolition (C&D) waste reduction, reuse and recycling on New York City Projects. Its basic goal is to assist design and construction professionals to prevent construction waste and to divert from landfills the C&D waste that is generated. The guidelines are addressed to all the participants in projects for the NYC Department of Design and Construction (DDC) Administrators and managers from DDC; Architects and their consultants; Construction Managers; and Contractors. C&D Waste management is a cooperative effort. DDC's Office of Sustainable Design supports and encourages committed action with this handbook.



EXECUTIVE ACKNOWLEDGEMENTS

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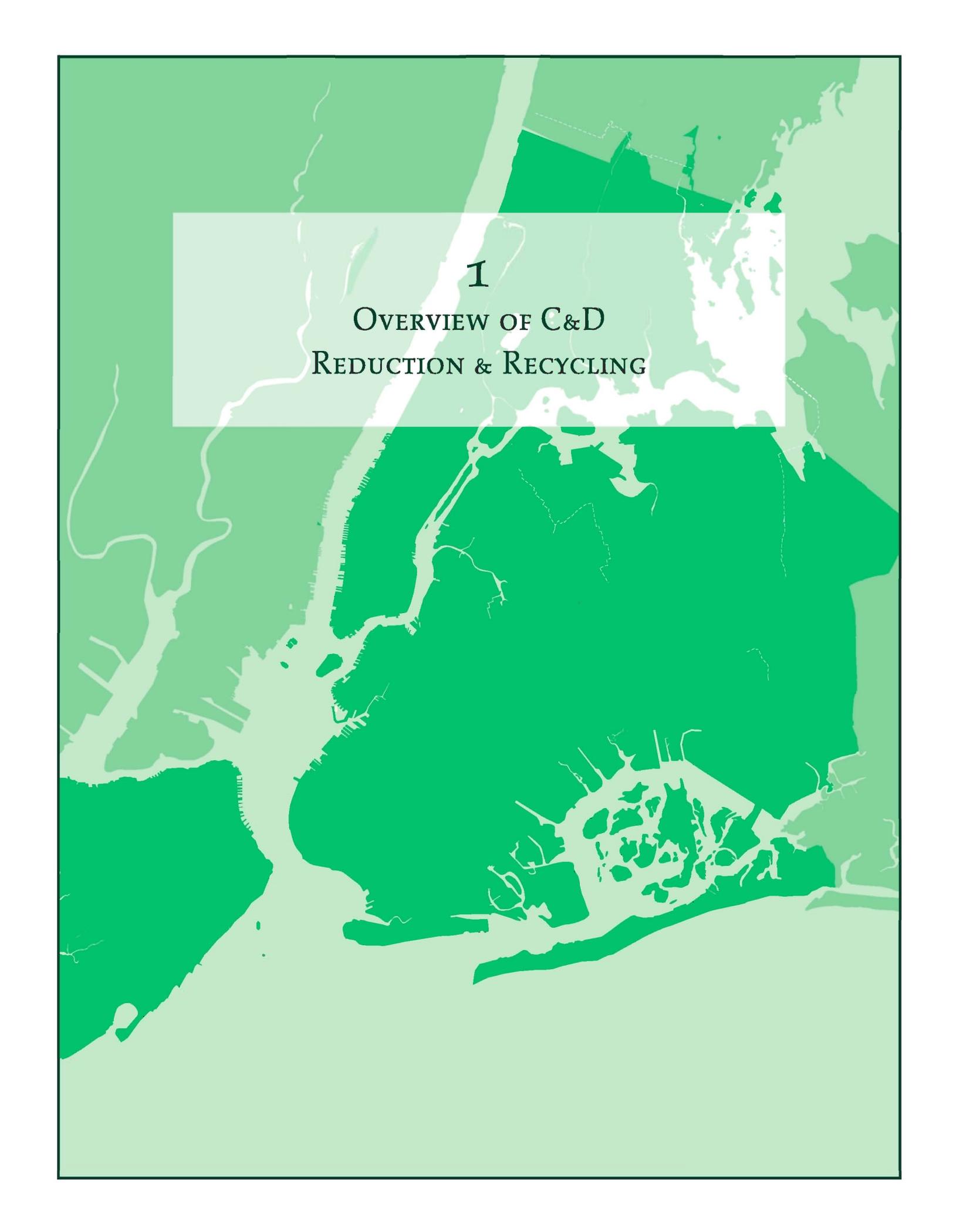
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May 2003



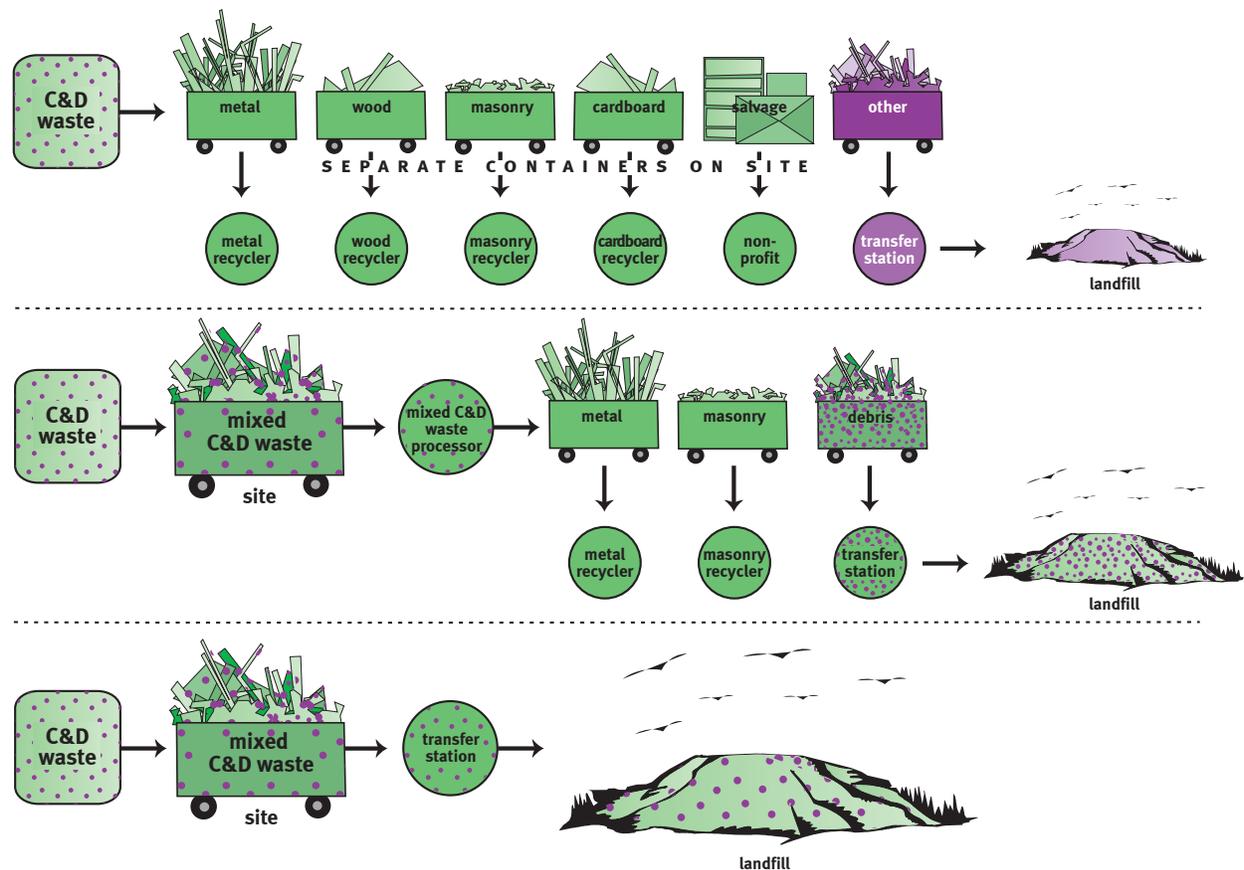
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OVERVIEW OF C&D
REDUCTION & RECYCLING

Overview

Solid waste management is undergoing dramatic change throughout the United States. It has become one of the largest budget costs for local governments. Landfills are reaching capacity, with thousands scheduled to close within the next few years. The construction of new facilities for either recycling or disposal is enormously contentious, fueling ongoing battles between waste exporting and waste importing states. This is a particular issue for New York City, which no longer has any disposal facilities and must export all the waste it does not recycle.

The closure of Fresh Kills Landfill, New York City's last remaining landfill, has resulted in a \$400 million annual increase in the NYC Department of Sanitation's budget since 1996, and the City's shift to waste export no doubt provided added impetus for the \$4 per ton tax that Pennsylvania recently imposed on waste disposed of in its landfills. Opposition to the construction of new rail-and-barge-served transfer facilities in NYC has resulted in a waste export system that is almost entirely dependent on trucks, aggravating local air quality and congestion problems with hundreds of thousands of additional trucks each year. In the 1990s, tipping fees for disposal at transfer stations in NYC were in the \$50's per ton range. Currently they are in the mid-\$60's to \$80 per ton range, and are expected to continue to rise. Nearby states are in the same situation. Connecticut is running out of landfill capacity, specifically for construction and demolition debris, and Massachusetts is considering a disposal ban on certain construction and demolition waste materials, such as asphalt, concrete, metal and wood. Chartwell Information projects a 63% price increase at mid-Atlantic landfills by 2010.

THREE CONSTRUCTION & DEMOLITION WASTE PATHWAYS



But waste management is not just a money issue. Waste prevention, reuse and recycling can not only save money, but also generate broad environmental benefits, including the conservation of natural resources. Reuse and waste prevention reduce the air and water pollution associated with materials manufacturing and transportation. This saves energy and reduces attendant greenhouse gas production. The recycling of many materials requires less energy than production from virgin stock, and can also reduce transportation requirements and associated impacts.

With an annual construction budget of approximately two billion dollars, including substantial renovation and demolition work, the DDC’s projects generate significant construction and demolition waste. The DDC seeks to increase prevention and recovery of waste materials generated by its own projects. It also is interested in encouraging the industry that manages New York’s C&D debris to develop more and better capacity to recover waste materials and thus reduce the City’s reliance on exports to landfills. This is critical because C&D debris accounts for well over half of New York’s waste stream.

EXISTING C&D WASTE MANAGEMENT PRACTICES IN NYC

Construction and Demolition (C&D) debris is defined as that part of the solid waste stream that results from land clearing and excavation, and the construction, demolition, remodeling and repair of structures, roads and utilities. Nationwide, C&D debris accounts for 25% to 45% of the total solid waste stream (by weight), with the balance consisting of regular municipal and commercial trash. In NYC, C&D accounts for more than 60% of the solid waste stream, according to a recent study by the NYC Department of Sanitation (DOS). There are a number of possible explanations for NYC’s high average C&D generation rate. One major factor is that different municipalities count different materials as C&D. For example, Portland OR does not count concrete,

NYC C&D Processors		
	Fill Material	Other
Bronx	4	6
Brooklyn	3	13
Manhattan	2	0
Queens	10	5
Staten Island	3	6
TOTAL	22	30

Source: NYC Department of Sanitation, Calendar Year 2000

dirt, brick or asphalt (known as “fill” materials) in its C&D tonnage. King County WA and Oakland CA do not count clean dirt generated by excavation work. In San Jose CA, the director of the C&D program estimates that a total waste stream analysis would show that concrete tonnage alone is double the rest of the solid waste stream in the municipality.

When clean fill materials are excluded, C&D in NYC accounts for about 39% of the waste stream, which is comparable with national figures. One reason NYC may still be at the high end of the range, even without including fill materials, is the fact that the New York is a relatively old city. There is older building stock and, hence, a relatively high degree of renovation activity. NYC is also fully developed. Thus, for almost every new building that goes up, an older one must come down.

C&D waste includes concrete, stones and dirt generated during excavation (sometimes collectively referred to as “fill material” or rubble), as well as asphalt, wood (treated, painted and clean), metal (ferrous and non-ferrous), and miscellaneous materials (dry wall, insulation, light fixtures, carpeting, etc.). According to a study recently completed by the Department of Sanitation, each day NYC produces about 19,500 tons of “fill material”, 13,500 tons of other C&D materials, and 21,100 tons of what is known as putrescible waste, which is the normal day-to-day trash thrown out by residents and businesses.

Construction and demolition waste is managed almost exclusively in NYC by private transfer stations and processors.* It is a waste stream that is separate and distinct from residential and commercial waste, commonly called municipal solid waste

* NYC Department of Sanitation operates a rock crushing plant at Fresh Kills landfill, which takes concrete and stones from some City construction projects

(MSW). Residential MSW in NYC is managed by the Department of Sanitation. Commercial MSW is handled by private waste haulers and transfer stations. Hazardous and liquid wastes also have their own special disposal procedures and regulations, and certain construction and demolition projects may generate hazardous materials that require special handling. Hazardous wastes frequently encountered in demolition projects include

asbestos, lead paint, and mercury from fluorescent lamps. This report does not address the management of hazardous waste, with the exception of certain products, such as light fixtures, for which there may be reuse or recycling opportunities.

Key Lessons from Successful Case Studies

- Support for waste management from the top
- Incorporation of C&D waste issues early
- Planning, clear goals and targets
- Sensitivity to specific project constraints and markets
- Coordination, education and communication

C&D waste goes through several steps in its progress from job-site to ultimate destination. The contractor collects the debris in containers, usually rented or provided by the hauler. A hauler takes the containers to a waste transfer station and/or processing center. Transfer stations transfer the waste into larger trucks, which take it to landfills located outside the City. Processing centers are in the business of either: a) accepting specific, separated, materials such as metal; or b). extracting recyclables from mixed loads before sending the balance to a transfer station. There are many different possible arrangements. Some large transfer station companies also have processing facilities and hauling services. Some contractors haul their own waste and recyclables. And many recyclers of specific materials will arrange to pick them up at the construction site.

The C&D waste industry operates in an environment where commodity prices (i.e., metal, paper, fuel, etc.) and competing landfill disposal costs constantly change, making it difficult to provide accurate information about recycling rates and costs. This also prevents one from suggesting a "typical" approach.

Source separation generally yields the highest recycling rate and the best price for materials. The contractor locates separate containers on the job-site, sorting out recyclable materials as they are collected, and delivering each container to the processor when full. The best opportunities for source separation tend to occur during the demolition and excavation phases of a project, when more C & D waste is generated and one contractor is scheduling the work. Additionally, demolition and excavation work can generate relatively homogenous waste streams. For example, asphalt millings may be generated as a single material stream. During excavation, containers of "clean fill" may be generated. There may be opportunities for on-site segregation of metal or for the grinding, screening and reuse of concrete.



Fresh Kills Landfill, New York, before its closure

For those sites that can accommodate source-separating of materials, NYC has a number of facilities that accept segregated streams. For example, scrap yards accept only metal, and "clean fill" processors accept only concrete, dirt and other inert materials. These facilities recycle virtually 100% of the material they handle, and their fees for accepting segregated materials are much lower than those charged by mixed C&D processors. The price differential differs depending on material. For

example, a 20 cubic yard container of metal only might be hauled away at no cost, whereas removal of the same container filled with mixed C&D might cost \$650.

More common in New York is mixed C&D waste recycling, particularly for wastes generated during the construction phase. It can be difficult to accommodate multiple roll-off containers at many NYC construction sites, so on-site separation of materials is rare. As a result, waste materials generated during NYC construction projects are generally collected and handled as mixed material, which is typically hauled to a processing facility or transfer station. Depending on the make-up of the material, processing facilities may recover metal, concrete and brick for recycling. Wood waste may also be

recovered for recycling into a mulch or fuel product. Material not removed from mixed C&D waste through processing is either shipped to landfills for disposal, or, in some cases, it may be ground up and exported for use as alternative daily cover at landfills, a practice that may or may not be classified as recycling, depending on one's definition.

Demolition and renovation jobs may offer salvage opportunities. For example, a recent NYC firehouse renovation project was preceded by removal of sinks for resale. As noted in the case studies, construction of the new New York State Department of Conservation headquarters building in Albany entailed reuse of 200 tons of granite paving stones, and the demolition work that preceded the construction of Four Times Square included the salvage of wood timbers, stone work, doors and architectural features.

Detailed data on citywide recycling rates for NYC C&D waste are not available. However, DOS estimates that approximately 60% of fill materials and 40% of non-fill C&D materials currently are being recycled. The C&D recycling that is already happening is driven by cost savings for contractors and processors. Opportunities for more aggressive reuse and recycling will improve as the potential for cost savings increases and as processors improve their capacity to handle and market the recoverable materials, and as the construction industry becomes more aware of savings that could accrue from more aggressive recycling. In this effort, the DDC is in a very influential position. With a budget of \$1 billion in building and \$2 billion in infrastructure projects a year, the DDC manages the waste from some 400 projects, giving the Department great "buying" power over waste processing services, and the opportunity to help educate the industry.

In practice, the design and project management community typically does not know the disposal path of a project's non-hazardous C&D waste. Architects, project managers and construction managers delegate that responsibility to the contractor. Their supervision of waste disposal has concentrated on the aspects that could be detrimental to site safety, potentially damaging to constructed areas, or unsightly. The DDC's own General Conditions cover just these issues. Implementing a significant waste management program will require the awareness and participation of all parties, because setting goals,

Is This Recycling?

Wood waste as boiler fuel?

Ground up wood waste is sometimes converted into energy as boiler fuel, but does it count as C&D waste recycling? California State policy say no, although The City of San Jose gives partial credit. Massachusetts and Washington State also say no, whereas Oregon says yes. New York State or City has no formal classification.

Crushed C&D Waste as Alternative Daily Cover (ADC) for Landfills?

(This replaces soil that typically would be used.)

Most states that have a position say no. San Jose, again, gives partial recycling credit. In New York, the State issues Beneficial Use Determinations that allow for the use of ground C&D as ADC, but there is no formal designation of the practice as recycling.

defining responsibilities, education and follow-through ultimately involves everyone. Cooperative effort can make this a success, despite the challenges particular to New York City, including:

- **Space at construction sites.** Staging area is at a premium on most of the City's construction sites, often limited to curbside. If the plan is to keep recyclables separate, then coordination, education and policing will be critical. If the plan is to send mixed C&D to a processor for recycling, there may still be materials that must be kept separate, such as food refuse, coffee cups, bottles, cans, and so forth.
- **Responsibility under the Wicks Law.** Wicks Law, established in 1912, requires four prime contractors on any public project over \$50,000, each with a separate contract with the owner, making cooperation and shared responsibility difficult to orchestrate.
- **Labor costs.** The Prevailing Wage Rates in NYC are higher than most other cities, which might make contractors hesitant to invest in more labor-intensive C&D waste recovery procedures.
- **Reluctance to change patterns.** Many construction companies have long-standing alliances with haulers and processors/transfer stations, which may not be the ones that can recycle a given project's debris.
- **Establishing appropriate targets.** There is little solid, industry-wide, information on recycling rates in the New York City area to use in developing a reasonable recycling requirement. Additionally, the DDC has a very wide range of project types, which generate very different waste streams.

WHAT WEST COAST CITIES ARE DOING

MUNICIPALITIES IN CALIFORNIA

The California Integrated Waste Management Board is setting a statewide target of 50% diversion of all C&D waste sent to landfills. In response, California's municipalities and counties have passed a wide range of ordinances for C&D waste recycling. In Sacramento, all new commercial, institutional and multi-family developments must provide a Recycling Information Statement outlining a designated area (which is sized according to a formula) to be set aside for the collection and storage of recyclable materials, a materials flow diagram, and an educational program. The Town of Atherton has specific diversion requirements by material and project type. For example, demolition projects must achieve a 50% recycling rate if asphalt and concrete are included, and a 15% recycling rate excluding asphalt and concrete. Santa Monica requires a Waste Management Plan and a 60% recycling rate (no more than 20% of which can be achieved through recycling of clean fill materials). Santa Monica also requires a performance security fee that is returned in whole or in part upon full or partial demonstration that recycling targets have been met. The City of Cotati requires any entity, public or private, intending to demolish a structure to advertise potentially salvageable materials available prior to demolition. Two other California examples are described in greater detail below. For further information on California's C&D recycling efforts go to: www.ciwmb.ca.gov

SAN JOSE, CALIFORNIA

In July 2001, the City of San Jose instituted its Construction and Demolition Diversion Deposit (CDDD) Program. All projects requiring a building permit now also require a CDDD Program deposit, which is calculated according to project size and valuation. This includes city construction projects that require building permits and private new construction, alteration or demolition projects, with certain exemptions. City construction projects that do not require a permit do not fall under the deposit system, but still have recycling reporting requirements. While private projects are required to achieve a 50% recycling rate (see below), city projects are held to a higher standard and are expected to achieve a 75% recycling rate, as part of a larger program to obtain LEED Silver certification for all city buildings.



To retrieve their deposit, private project developers must demonstrate that they have recovered a minimum of 50% of the C&D waste they generate. This can be accomplished by delivering C&D to a city-certified processor and assembling the necessary documentation, or through reuse of materials, either on-site or at another location. The latter option entails its own documentation and is subject to city approval. It is worth noting that a majority of large projects now reuse rubble (concrete, brick, stone, etc.) on site as fill.

There are two categories of processing facilities in terms of San Jose certification. Those that process source-separated materials, such as scrap metal dealers and clean fill processors, must establish that they handle only source-separated materials. These processors are automatically certified and they have no further reporting requirements; it is assumed that these processors achieve a recycling rate of 90% or higher. For facilities that handle mixed C&D, there are ongoing reporting requirements to demonstrate what recycling rate is being achieved.

San Jose has addressed the issue of using ground C&D as alternative daily cover (ADC) at landfills creatively. When the CDDD Program was initiated, using C&D as ADC was discounted 50%. In other words, 50% of the tonnage diverted to ADC could be counted towards the total recycling rate. To encourage higher uses than ADC, the City is in the process of revising its rules so that only 25% of C&D used as ADC can be counted towards the recycling rate. In anticipation of this change, and in order to remain as certified facilities, vendors are investing in additional processing capacity that will allow them to access higher end uses than ADC, according to City officials.

Two aspects of this program indicate that it is working well. First, virtually everyone comes back to the City to reclaim their deposit, and 98% provide the documentation that the City requires to return the deposit. Second and related, processors have determined that being certified is sufficiently important to maintain their customer base that there has been no problem in getting them to provide the City with the documentation required for certification.

OAKLAND, CALIFORNIA

The City of Oakland requires contractors to prepare a Job Site Recycling and Waste Reduction Plan (JSR and WRP) for any municipal construction or demolition project where the cost exceeds \$150,000. A completed JSR and WRP must be submitted with the rest of the bid package.

The JSR and WRP must include, among other things: estimated type and quantity of waste to be generated, on-site material handling procedures, specific processors/recyclers that will be used and materials that will be recovered. The JSR and WRP is reviewed by staff from the Environmental Services Division of the Public Works Agency based on the following criteria: a) reasonableness of materials targeted for recycling, reuse or salvage based on the project and local markets for materials; and b) constraints of the job site.

Unlike San Jose, Oakland leaves itself flexibility and discretion with regard to what recycling rate to require. While this approach entails more work on the part of City staff, it recognizes the inherent variability of C&D.

Although Oakland does not require a specific recycling rate, it is operating under the state-wide goal structure established by the California Integrated Waste Management Board, which is an overall diversion waste diversion rate of 50%. Oakland estimates that C&D makes up 16% of its waste stream.

WHAT DDC CAN DO

- Serve as an educational and informational resource
- Establish goals and/or requirements for its projects
- Document successes and failures and disseminate results
- Identify and enact measures to improve the C&D industry

SEATTLE/KING COUNTY, WASHINGTON

It is estimated that C&D waste comprises 20% to 30% of the waste stream in King County. In the Seattle area there are strong markets for concrete, asphalt, brick, rock, lumber and architectural features, and the current recycling rate for C&D waste is estimated at 30% to 40%. Since 1993, Seattle has had a Construction, Demolition and Land clearing (CDL) Program, which focuses on education and technical assistance for the building industry.

The County has adopted a policy that the marketplace, rather than government subsidies, must drive recycling of C&D, so C&D waste recycling is voluntary, not mandatory. However, the CDL Program has two full-time employees, who identify upcoming projects that are expected to generate significant volumes of C&D, contact the developers and work with them to create a waste management plan. They also maintain a directory of processors and case studies of successful C&D recycling projects.

PORTLAND, OREGON

Portland is a rapidly growing city and estimates that 28% of its waste stream is C&D waste. All construction projects over \$25,000 must have recycling programs for C&D. When developers apply for their building permits, they are provided with C&D recycling information, including a directory of area processors, and a one-page form on which they must indicate how they will recycle five materials: wood, metal, yard debris, corrugated cardboard and rubble (concrete, asphalt, stone, brick, dirt, etc.).

The city employs a half-time inspector, who visits construction sites at random. Source-separation of different C&D materials is not required if the developer is planning on using a mixed C&D processor. However, food waste and other municipal solid waste must be kept separate from all C&D materials. The inspector is authorized to fine developers, but this is typically reserved for chronic offenders. More commonly, the inspector provides information and technical assistance. While City officials have determined that they have a healthy C&D recycling program based on the amount of processing activity that occurs, they do not attempt to track the specific recycling rate for individual construction and demolition projects.

OTHER LARGE CITIES

Like New York City, a number of large cities have no requirements for C&D waste recycling, but have an active recycling sector for certain C&D materials, as a result of market conditions. Cities that do not have any formal recycling requirements include Los Angeles and Chicago. Boston currently has no recycling requirements but the State is considering regulations that would prohibit landfilling of key C&D materials, including asphalt, brick, concrete, metal and wood. Philadelphia has recycling rules on the books, including a requirement for recycling plans and potential fines for noncompliance, but there is virtually no enforcement. Thus, C&D waste recycling in Philadelphia is also driven by economics.

SUMMARY OF MUNICIPAL STRATEGIES

Municipalities across the country are approaching C&D recycling in a wide variety of ways. These efforts fall into three general categories: a) those that let the market determine what gets recycled; b) those that encourage recycling by requiring plans and providing information and technical assistance; and c) those that require recycling through documentation of recycling rates and imposition of penalties for non-compliance.

RELEVANCE TO THE NYC DEPARTMENT OF DESIGN & CONSTRUCTION

In New York City, the economics of recovery vs. disposal has resulted in a substantial C&D recycling industry. So why should the Department of Design and Construction strive to expand and improve its project waste management? First, it is the right thing to do, for the environmental benefits of resource conservation, energy savings and pollution prevention. Public awareness of, and government appreciation for, these environmental impacts is expanding. The second reason is that diverting C&D debris from landfills can save money on the DDC's projects. Disposal occurs in landfills that are increasingly distant from the City, in states that are increasingly unhappy about receiving out-of-state waste, so disposal costs are increasing. A third reason is that the DDC is a major player in the NYC design and construction industry, with direct responsibility for a substantial amount of C&D waste, and the ability to influence the C&D waste management industry as a whole. Finally, given the fact that C&D waste still accounts for 60% of New York city's waste stream, there remain tremendous opportunities for improvement in New York's waste management practices.

The DDC has already taken some steps to encourage C&D recycling. In its 1999 High Performance Building Guidelines, the DDC identified strategies for C&D waste prevention and recycling. For select High Performance Building projects that the DDC has targeted for a LEED rating, C&D waste management has been one of the issues addressed



(projects include the Queens Botanical Garden and the Brooklyn Children's Museum). In 2002, DDC introduced specifications for utilization of recycled-content building materials in all DDC projects.

This report is part of an effort to more aggressively track and encourage C&D waste reduction and recovery, for both high performance building projects and DDC projects as a whole. In doing so, the DDC seeks to take a stronger leadership approach for its own projects without creating an overly burdensome system. Specifically,

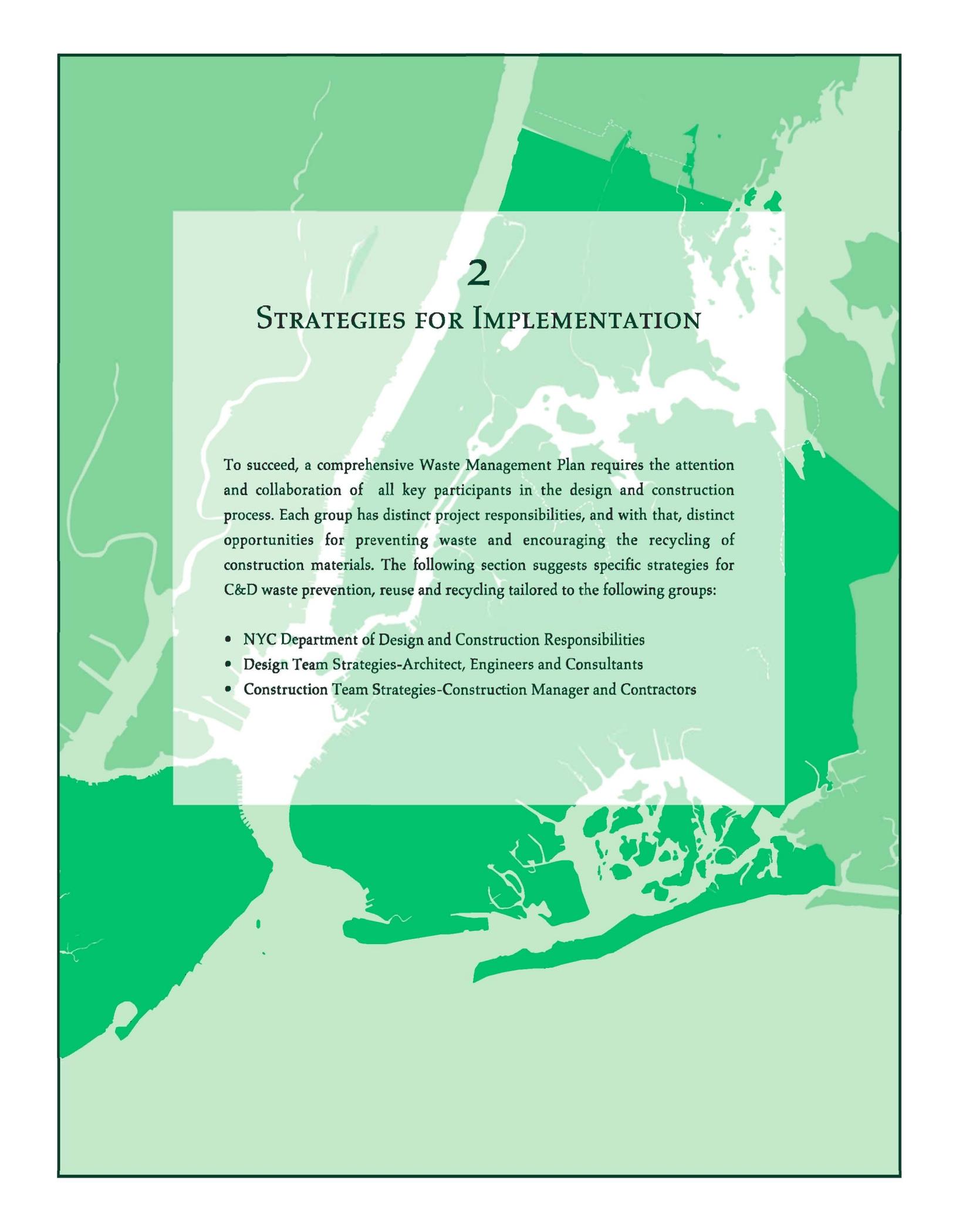
- DDC has produced this report of strategies and other useful resources, such as case studies of successful C&D recovery projects. A separate updated directory of processors is available from DDC's Office of Sustainable Design.
- DDC has developed a new specification requiring the development of a Waste Management Plan, which will be required on all DDC projects. The DDC also has developed a specification for LEED projects, which requires either 50% or 75% waste recovery, depending on the level of LEED rating that is being sought (see Section 3. Implementation Resources). Both specifications encourage recycling and provide DDC with a mechanism to track results, document success stories and highlight areas where more attention is needed.
- DDC continues to target specific High Performance pilot projects where efforts will be made to maximize waste reduction and recycling.

As next steps, DDC intends to:

- Gather and audit submittals required by the new specifications.
- Identify select pilot projects for the training of DDC project managers and the rest of the design/build team, which will include the evaluation of the impact, possible cost and logistical and bookkeeping issues associated with the different C&D waste management strategies.
- Explore alternative methods for encouraging recycling and tracking recovery rates, such as that employed by San Jose, California (see above).

HOW TO USE THIS BOOK

This document is intended to be a resource for the NYC Department of Design and Construction, its design consultants and construction teams. The subsequent chapter makes suggestions about how each member of the project team can help in the reduction, reuse and recycling of C&D waste. Specific resources include suggested Specifications and a sample Waste Management Plan—see the Implementation Resources chapter for information.



2

STRATEGIES FOR IMPLEMENTATION

To succeed, a comprehensive Waste Management Plan requires the attention and collaboration of all key participants in the design and construction process. Each group has distinct project responsibilities, and with that, distinct opportunities for preventing waste and encouraging the recycling of construction materials. The following section suggests specific strategies for C&D waste prevention, reuse and recycling tailored to the following groups:

- NYC Department of Design and Construction Responsibilities
- Design Team Strategies-Architect, Engineers and Consultants
- Construction Team Strategies-Construction Manager and Contractors

Strategies for Implementation

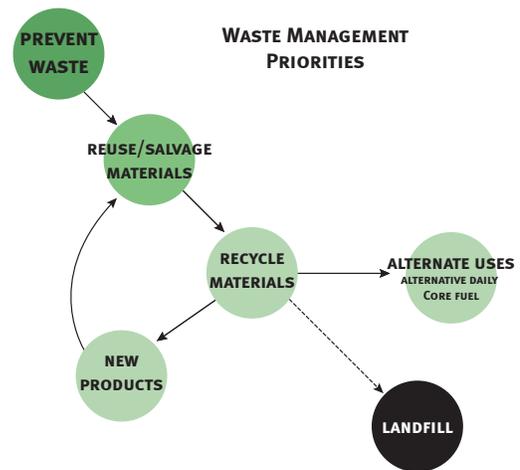
Reducing construction and demolition (C&D) waste requires commitment and attention by all parties key to the building's construction, but is not inherently complicated. Small steps by each participant—DDC, consultants, contractor—yield results. Significant waste prevention and diversion from landfills requires that we view materials as resources to be conserved.

Opportunities for reducing C&D waste focus on three approaches, typically expressed as Reduce—Reuse—Recycle.

Reducing waste, the first approach, yields the greatest environmental benefits. Using less material costs less, reduces pollution from its manufacture and transportation, saves energy and water, and keeps material out of landfills. Waste reduction should be the top priority in your waste management plans.

Reusing, the second approach, extends the life of existing materials and decreases the new resources needed. Of course, entire buildings can be reused through renovation, whether for the same or new use, saving both resources and money. The reuse or salvage of building components, common in historic renovations, is being extended to non-decorative elements such as doors and light fixtures as well. This approach can be pushed further by not assuming that new always performs better. For example, energy modeling for two EPA headquarters buildings found that adding interior storm windows saved more energy than new windows, cost less and didn't expose the interior to the elements during construction. And as a long-term approach, designing buildings to easily accommodate evolving use and technology is an excellent and sometimes overlooked strategy to prevent future waste.

Recycling, the third approach, again conserves resources and diverts materials from landfills. Demolition and renovation projects, which account for approximately two-thirds of DDC's work, present numerous opportunities for recycling. The most sustainable form of recycling converts waste into new products, such as scrap to new steel or asphalt into new paving. Additionally, finding alternative uses for waste is a form of recycling. Inert waste, such as concrete and brick, can be crushed and used as alternative daily cover for municipal landfills, substituting for dirt, or wood scrap can be burned as boiler fuel.



The three practices—reduction, reuse and recycling—combined with disposal of non-recyclable materials, make for a comprehensive waste management strategy. Everyone plays a part in the process. The **Department of Design and Construction**, as the client and manager, sets and maintains the direction. The **Design team** of architect, engineers and other consultants, takes the initiative in waste prevention and reuse, and sets the goals for recycling. The **Construction team** plans and implements the recycling program and practices prevention and reuse on the jobsite. To succeed, the reduction of C&D waste must be an integral part of the decision-making, with each group planning their strategies and seeking cooperation and dialogue. Following are suggested strategies and responsibilities for each group.

DDC – STRATEGIES & RESPONSIBILITIES

The breadth of the DDC’s influence is great, based on an annual project base of approximately two billion dollars in construction. The Department has great “buying” power over waste processing services and a responsibility to both recycle its waste and to set an example for New York. The DDC is taking a leadership position in C&D waste prevention and recycling, as well as in other aspects of sustainable design.

RESPONSIBILITIES FOR DDC PROJECT MANAGERS

The DDC’s project managers are responsible for ensuring that the design and construction teams outline and implement a Construction & Demolition (C&D) waste management plan.



Design Phase Responsibilities

DDC’s design project managers implement agency priorities and direct the design teams. C&D responsibilities include:

- Make sure that the specifications for all projects include a C&D Waste specification. For typical projects, the C&D Waste Specification: Typical Project should be used. For LEED projects, the C&D Waste Specification: LEED Project should be used. Boiler-plate specs for both are included in the Sustainable Design section of DDC’s web site.
- The Design Phase Project Manager is responsible to ensure that the project’s C&D Waste management goals are aggressive and that a C&D Waste specification is developed for the project.
- Start early in the design process to identify opportunities for salvage and/or recycling. Note that demolition and renovation projects offer considerable opportunities for salvage, reuse and recycling.
- Instruct the design team to consult the list of Principal Recyclable Materials on the following page while developing the project’s waste management goals.
- Review and discuss waste management goals as part of the project’s progress meetings.

Case Study: Presidio, San Francisco, CA, Port of Oakland, Oakland, CA

Building 901 at San Francisco’s Presidio (a former military base) and Building 733 (a large warehouse) in the Port of Oakland are two examples of deconstruction rather than demolition. Building 901 was dismantled in one month, yielding 66,000 board feet of old growth Douglas Fir and Port Oxford Cedar. Total deconstruction costs were \$53,000. The sale of recovered lumber generated \$43,660 in revenues, leaving a net cost of \$9,340. The competing demolition bid was \$16,800. Building 733 yielded 450,000 board feet of old growth Douglas Fir, providing an income of \$280,000. Deconstruction costs were \$330,000, leaving a net cost of \$50,000. The competing demolition bid was \$150,000. The recovery rate for Building 901 was 87%; the recovery rate for building 733 was 70%, not including wood waste that was chipped for use as fuel.

Construction Phase Responsibilities

DDC’s construction project managers implement the project’s agenda during the construction phase. C&D responsibilities include:

- Work with the Construction Manager (CM) and the Contractor for General Construction to develop an aggressive Waste Management Plan (WMP), in accordance with the specification developed by the design team. A sample Waste Management Plan is available in the Sustainable Design Section of DDC’s web site. A walk-through of the site with the construction team, including the demolition contractor, could help in determining materials to be salvaged or recycled.

- Feel free to ask the DDC’s Office of Sustainable Design for assistance in developing the WMP.
- Review the Waste Management Plan submitted by the Contractor, and the periodic reports of recycling practice.
- Keep track of of the C&D Waste management, based on the specification requirements and approved Waste Management Plan. Compare recycling progress to the Plan and bring lagging results to the Contractor’s attention.
- Keep both waste management and the use of quality materials as priorities during the construction, and resist their abandonment because of schedule pressures, value-engineering or contractor coordination issues. Written goals and discussion at job meetings are key.
- Schedule regular walk-throughs and prompt inspections to catch problems early, which will help prevent waste and ease coordination between trades.
- Collect information from the design team concerning plans for flexibility and future waste prevention measures—such as spare capacities, modular components, etc.—and pass them along to the building’s management.

Principal Recyclable Materials for New York City

The principal materials present in the NYC C&D waste stream that are currently recyclable in the New York City area include:

- Asphalt
- Brick
- Corrugated Cardboard
- Carpet
- Concrete
- Film Plastic
- Fluorescent Lamps
- Glass
- Land Clearing Debris
- Metal
- Pallets
- Roofing (asphalt)
- Wood

Materials that manufacturers will take back if they are installing new material include:

- Carpet
- Ceiling Tile

Materials common in the C&D waste stream that could be recovered, but for which there is currently no local market/outlet include:

- Gypsum/Dry Wall (Current Outlet in Montgomery, NY)
- Rigid Foam Insulation (Current Outlet in Florida)

Materials that may be salvageable before renovation or demolition begins include:

- Appliances
- Architectural Features
- Circuit Breakers
- Office Furniture
- Windows/Doors
- Wood Timbers

DDC Resources provided by the Office of Sustainable Design and Construction

Organized reuse and recycling is a relatively new idea, and some barriers are perceived, rather than real. Assistance and resources from DDC’s Office of Sustainable Design (OSD) can encourage the management, design and construction professionals. Assistance and services provided by the OSD include:

- Making the tools in this document available to project teams, and adapting them over time to reflect successes and challenges.
- Providing direct assistance to help the design team and contractor set goals and develop a project-specific Waste Management Plan.
- Providing seminars on sustainable design in general, and C&D Waste Management specifically.
- Collating and analyzing the data on the DDC’s current and ongoing recycling, to monitor the trends, project variations and key markets. To assist the OSD in this, please collect the Recycling Report submittals required in the specifications and forward a copy to the OSD.

DESIGN TEAM – STRATEGIES

Construction and demolition waste prevention, reuse and recycling begin in design. The Department of Design and Construction (DDC) sets the tone, and the design team – architect, engineers and other consultants – develops the framework and the project-specific goals. Architects must add C&D waste reduction and recycling into balancing of many priorities in the design process.

For all DDC projects, the design team is responsible for drafting specifications describing the C&D waste requirements, by tailoring DDC's standard specification sections (see www.nyc.gov/ddcgreen). If the project is seeking LEED certification, the team will establish a minimum diversion requirement of either 50% or 75%. If it is a typical project, the specification allows the team to choose between two goals – an overall goal of 50% minimum diversion, or goals of 80% recycling for each of the major building materials. Determining the specification, then, will require the team to focus on how much recycling can realistically be expected on the project. Note that since most of the waste on DDC projects is generated during demolition, analyzing the existing conditions for salvage and recycling opportunities is major part of the specification-writing process for the design team.



Additionally, the design team can make strategic design decisions that prevent waste during construction as well as over the life of the building. Following are suggested strategies for waste reuse, recycling and prevention.

Strategies - Reuse and Recycling

Survey existing buildings for items that could be salvaged and reused.

Renovation, a majority of DDC work, yields opportunities for reusing building components on the project, or salvaging them for another building. Reuse is implicit in historic renovation, but other projects also present opportunities. Strategies include:

- Start in the schematic design phase.
- Review the existing furnishings and equipment to determine which items are in good condition and could be reused to meet the planned program, could be salvaged for another DDC project or donated to a non-profit group. (Ask OSD for suggestions.)
- Identify system components and equipment with reuse potential, such as chillers, ductwork and lighting, but weigh their reuse in light of future energy efficiency, indoor air quality or early replacement.
- Assess the architectural components for possible uses and discuss with the client/user. Potential materials include doors, paneling, shelving, wood, stone/marble, lighting fixtures (relamped), windows, etc. Evaluate these with function, proposed location and ease of removal and storage (time/\$) in mind.

Encourage and require construction recycling.

The DDC requires that specification sections be included that require the contractors to recycle C&D waste. The DDC provides C&D specification sections that can be adapted to suit your individual project. Although some recycling is normal practice on every job, the DDC specifications require the contractor to develop a Waste Management Plan and to provide

documentation of the efforts and results. (See www.nyc.gov/ddcgreen to download specifications and a sample waste management plan.) Strategies include:

- At a minimum for all projects, use DDC’s **Typical Project** C&D specification sections. This version sets a target goal for recycling, and requires a Waste Management Plan and the collection of documentation.
- For a more rigorous approach, use DDC’s **LEED Project** C&D specification sections. This version requires that a specific minimum percentage of C&D waste be recycled, e.g. 50% or 75% percent by weight. The minimum percentage and documentation are aimed at meeting the U.S. Green Building Council’s LEED requirements (version 2.1) for Construction Waste Management credit.

Follow-through during construction.

Success will only be determined at the end of the job, when goals and reality meet. Vigilance is needed to survive the many construction pressures and competing priorities. Strategies include:

- Assist the contractor in developing a written Waste Management Plan that identifies the following: components to be recycled, reuse/salvaged, and landfilled; estimated amounts; processors that will receive the C&D waste; on-site procedures and responsibilities; and documentation to be provided.
- Discuss waste management at all job meetings.
- Observe the on-site provisions during site visits.
- Review the contractors' reports in a timely manner and compare to the Waste Management Plan to gauge progress, bring lagging results to the Contractor's attention.
- Forward the collected contractor’s reports to DDC’s Office of Sustainable Design, for agency-wide analysis.
- Be firm but flexible about real construction difficulties.

Case Study: Four Times Square, New York, NY

Four Times Square is a relatively new 48-story, 1,600,000 square foot office tower. The building was designed to address environmental building issues, such as energy efficiency and indoor air quality. The building was constructed at the intersection of Broadway and 42nd street and was completed in July 1999. Before construction could begin, demolition of 462,500 square feet was necessary.

Contractors on the project were required to efficiently use resources "to the fullest extent possible," which included recovery of C&D. Prior to demolition, private groups salvaged more than 110 tons of wood beams and architectural features. During the demolition phase, project coordinators worked closely with the contractor and required reporting on tonnage data and recycling rates. Prior to construction, contractors were notified about the importance of materials recovery, and told payment would be withheld if contractors did not provide the required documentation. Due to the tight site constraints, on-site separation was not practiced. Instead, mixed materials were removed to a mixed C&D processor.

According to the Environmental Consultant on the project, an overall diversion rate (by weight) of 58% was achieved. The table below shows data for the project.

Project Phase	Waste Generated	Waste Disposed	Materials Diverted
Demolition	27,027 tons	11,097 tons	15,930 tons
Construction	3,287 tons	1,383 tons	1,904 tons
Total	30,314 tons	12,480 tons	17,834 tons

Primary materials diverted during demolition were scrap metal, brick, concrete and dirt, and during construction, scrap metal, cardboard, wood, dirt and rock. Materials salvaged prior to demolition included wood timbers, ornate stone work, office doors, copper and facial corners. The environmental consultant on the project also helped contractors anticipate and reduce packaging waste during construction. Savings from recycling and reuse efforts were calculated at \$895,000, which were estimated to exceed the added costs involved with planning and instituting these recovery practices.

Strategies – Prevention

Anticipate change with a flexible plan.

Buildings are dynamic, adapting to new users, new technology and new architectural attitudes over time. Planning for change can minimize demolition, renovation and its related waste. Strategies include:

LEED IS...

Leadership in Energy and Environmental Design (LEED) is a program of the United States Green Building Council, a voluntary organization of building industry professionals, companies, environmental organizations and governmental groups. LEED is a certification standard for buildings, based on points granted for meeting sustainability goals in several categories: sustainable sites; water efficiency; energy and atmosphere; indoor environmental quality; materials and resources; and innovation and design process.

- Plan for easy technology upgrades, with accessible, organized wiring and expandable systems. Cable trays and raised floors are two examples of such systems.
- Choose modular sizes for interior rooms to reduce the frequency and extent of renovations. For example, two adjacent seminars rooms could become a new classroom if the size and proportion are correct. An office area with relatively few office size variations will result in less adjustment for different users.
- Group built elements together in office settings, to enable maximum flexibility for changes to open work areas and workstations.
- Design flexible mechanical systems, carefully considering Building Management Systems, points of control and monitoring, maximizing zoning, system modularity etc.

Detail with material economy and waste recycling in mind.

Many of the design decisions architects make are incremental, made while juggling a wide range of considerations. Add waste management to the design criteria, especially when in the design development phase. Sample strategies:

- Design to standard material sizes as much as practical, to avoid cut-off waste in plywood, gypsum board, block, panels etc.
- Consider prefabricated components, because off-site manufacturers are more likely to control and recycle waste.
- Recognize that the Wicks Law puts a special burden on coordination, and minimize complicated details that involve more than one trade.
- Use materials that are durable and low maintenance.
- Choose materials with recycled content.
- Select materials, building components and furniture from manufacturers that use minimal packaging, or will take it back.

Anticipate future changes.

All buildings change over time, and our decisions now determine whether a component can be reused or recycled in the future. Strategies include:

- Use mechanical fasteners (screws, nails, clips) to join materials rather than glue, and choose manufactured components without fused materials. For example, a very shallow hung ceiling can be totally recycled, but ceiling tiles glued to the slab become waste.
- Select materials that can be later recycled.
- Require components to be labeled in construction, to make modifications easy and prevent unnecessary replacement and exploratory demolition.

Consider the variety in details and materials.

For visual and functional reasons, a variety of building components are selected – different lighting fixtures, a range of flooring, etc.

Limiting the number of variations, especially interior finishes and fixtures, will prevent waste stemming from partial orders and damaged attic stock.

Sample strategies:

- Identify the areas of special emphasis, where variety and non-standard components are important, such as lobbies, auditoriums etc. Use a modest range of materials in other areas.
- Choose a variety of lighting fixtures, but limit the types of lamps they require.
- Use standard colors and finishes for heavy use areas, or large typical areas.
- Use modular components, such as carpet tiles, to make repair and replacement easier.

Specify materials with recycled content.

Using recycled materials conserves resources and helps divert waste from landfills. Also it supports and encourages the marketplace for the C&D waste that will be recycled from your project's jobsite. Strategies include:

- Use the DDC's **Materials With Recycled Content** specification (required; download from www.nyc.gov/ddcgreen). This provides specifications for the following products: Athletic and recreational surfaces; Coal fly ash in concrete; Plastic and wood/plastic composite lumber; Fiberglass building insulation; Sprayed-on fireproofing; Gypsum wallboard; Ceramic tile; Acoustic panel ceilings; carpet tile; Plastic toilet compartments and related items. (Go to CONTACT at nyc.gov/ddcgreen for a list of manufacturers for materials with recycled content.)
- Review your project for other opportunities to use recycled products.

Produce complete construction documents.

Uncertainty can engender waste and excess cost due to inaccurate ordering or field modifications, and a solid set of construction documents can lower that risk. Strategies include:

- Dimension and detail the construction drawings to a level sufficient for the contractor to accurately estimate materials.
- For renovation projects, take the time for an accurate field survey, to minimize surprises. This will probably save time in the end, as well.
- Specify mock-ups of tricky details or situations where aesthetics or system coordination might dictate a change.
- Document the as-planned decisions, in addition to the as-builts. Recognizing that you will be long gone when renovations occur, record the flexibility designed into the building for building management, such as the spare capacities, the operation and flexibility in the system controls, modular components used, areas where HVAC can easily support additional rooms, materials and finishes used and the suppliers of specialty items.

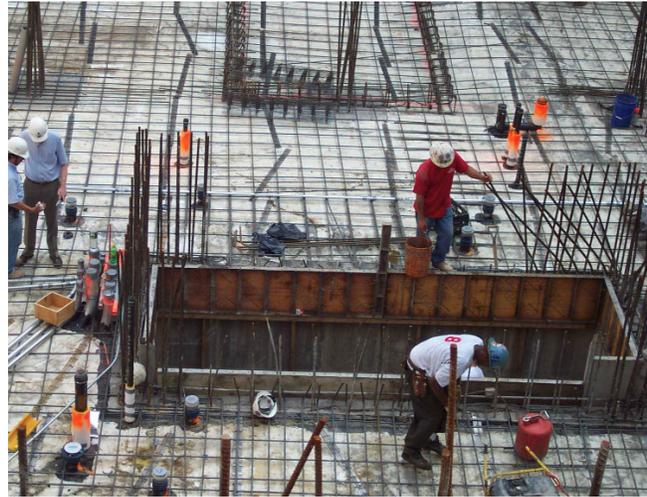
Case Study: New York State Department of Environmental Conservation (NYS DEC) Headquarters Building, 625 Broadway, Albany, NY

The new NYS DEC headquarters are located in a 15-story, 471,000 square foot building designed to house 1,900 staff. The building was designed using sustainable design principals and ultimately received a LEED silver rating. The building was constructed on an undeveloped lot in the Downtown Historic Area of Albany and was completed in September 2001. The project involved excavation and new construction; there was no demolition or renovation.

According to Michael Phinney, Lead Project Designer and Project Architect, the project achieved a 50% recycling rate (by weight) during construction, which does not include clean fill generated during excavation. Tonnage data was tracked but certain records were lost by the Construction Manager; therefore actual numbers were not available. Three categories of tonnage were tracked: materials sent to landfill; materials sent to a recycling facility; and materials re-used. The primary materials recovered were: wood pallets, gypsum board, metal, film plastic and Styrofoam. Additionally, about 200 tons of granite paving blocks were discovered during excavation; these blocks were stored on-site and later re-used in outdoor public areas. The Project Architect developed a waste management plan that involved using designated roll-off containers for on-site separation and collection of recyclable materials. Waste hauling companies were directed where to take containers. On-site separation was emphasized at weekly job-site safety meetings. Note that a 50% recycling rate qualified the project for one point on the LEED rating system. Had clean fill figures been included, it is estimated that the recycling rate would have exceeded 75%, which would have meant two points according to LEED. With regard to excavation work, there was a small amount of asphalt present, which was scraped off and taken off-site. The rest of the excavation material consisted of paving stones, which were recycled as noted above (this tonnage was included in the recycling rate), and "urban soil", which in this case was clean enough to utilize for fill work required during subsequent construction phases. As noted, clean fill materials were not included in the recycling rate.

CONSTRUCTION TEAM – STRATEGIES

The construction team—construction manager, four prime contractors and their subs—is responsible for implementing the project's reuse and recycling goals in a practical way. Some C&D waste recycling takes place on every DDC project, but the program to organize, increase and document it is a new idea. Challenges to be overcome may include: limited space on-site; real or perceived labor costs; changing customary haulers; and coordination under the Wicks Law, which is a strong factor in supporting separateness rather than shared procedures. However, recycling C&D waste is an environmentally responsible approach, and has been shown to save money on construction projects—see Case Studies.



For a given construction or renovation project, the DDC may choose to set up recycling in one of two ways: a) setting a minimum percentage of C&D waste to be diverted from landfills and collecting documentation of the results; or b) establishing a minimum requirement for diversion of specific materials. In either case, the construction team starts by developing a written Waste Management Plan that identifies the materials to be reused or recycled and the procedures the contractors will use. The design team and the DDC's Office of Sustainable Design can assist in drafting the Plan.

Strategies

Develop a Waste Management Plan.

Although recycling already takes place on most projects and every project is different, the development of goals, formal procedures and documentation are new. Planning will be necessary to effectively organize a site-wide effort, analyze its economics, and carry it out. Strategies include:

- Designate a Recycling Coordinator, who will be responsible for developing the details of the plan and monitoring its progress.
- Analyze the waste anticipated in the construction and demolition. Resources available to help estimate the types/amount of waste include the other contractors, waste disposal records from previous projects, and materials estimates from bidding.
- Target first materials that are plentiful, easy to recover, and those with low recycling costs or high paybacks.
- Dispose of all hazardous materials properly. Hazardous materials, such as asbestos-containing materials, lead paint and pcb-containing ballasts, are outside the scope of this document. Their removal and disposal are subject to Federal, State and City regulations. However, DDC requires that all fluorescent and HID lamps and all mercury-containing thermostats be recycled.
- Identify products, such as carpet or ceiling tiles, which will be picked up and recycled by the manufacturers.
- Determine the appropriate waste processors, considering costs, procedures, convenience and other pertinent factors. Some C&D waste processors will pick-up from the job site.
- Review DDC's Sample Waste Management Plan for a better understanding. (See www.nyc.gov/ddcgreen.)
- Plan on-site procedures that will accomplish your goals, using some of the strategies that follow.

Coordinate the Prime Contractors.

Each of the Prime Contractors has certain responsibilities with respect to construction and demolition waste management. The Contractor for General Construction typically manages the demolition, so is responsible for all aspects of the demolition waste management. This often constitutes the bulk of a project's waste. During construction, each Contractor is responsible for collecting, sorting and depositing their waste, and debris in designated containers, as per the Waste Management Plan. Each Contractor also is responsible for returning or recycling his/her pallets and packing materials per the WMP. The Contractor for General Construction is responsible for removing recyclables, other waste and debris from the site and disposing of it. Even with these clear divisions of responsibilities, there is a need to coordinate. Some strategies include:

- All Prime Contractors should be involved in developing the Waste Management Plan.
- Talk about it together before developing a Waste Management Plan in order to understand what recyclables each Contractor anticipates, the approximate schedule of their collection, and their disposal preferences.
- It is important that any separate recycling, reuse or salvage by the Prime Contractors be included in the overall Waste Management Plan, and that the appropriate documentation be submitted.
- For LEED projects, consult all Contractors to plan the percentage of waste each will be required to recycle. However, the specification sets the minimum overall project percentage. Demolition, typically a responsibility of the Contractor for General Construction, may provide the bulk of the LEED requirement, if demolition is part of your project.

Consider source separation first.

Source Separation collects recyclables in separate containers, which are taken to processors for that specific material. This yields the highest recycling rate, but space, labor costs and hauling issues in NYC may limit extensive use of source separation. Strategies to facilitate site separation include:

- Determine the space available and prioritize your containers.
- Concentrate on a few key materials to be source separated -- those that are easy, most valuable or abundant. Some materials must be source separated for payback, such as cardboard and metals. Others, such as carpet, ceiling tiles, and film plastic, will not be recovered in mixed loads.
- Question potential waste processors about their procedures, arrangements with waste haulers, and pick-up policies.
- Involve all the Contractors with the selection of materials, container locations and collection schedule.

CONVERSION RATES FOR C&D WASTE	
Mixed Waste	1 cy = 350 lbs
Wood	1 cy = 300 lbs
Cardboard	1 cy = 100 lbs
Gypsum Wallboard	1 cy = 500 lbs
Rubble	1 cy = 1400 lbs

Source: USGBC LEED Reference Guide June 2001

Augment separation with mixed waste recycling.

Mixed C&D waste can be hauled to a processing facility or transfer station where materials are recovered for recycling. The recycling rate for mixed C&D debris is lower than that of source separated. However, it imposes less of an on-site burden. Strategies include:

- Find a processor that will accept your mixed C&D waste for recycling and will provide documentation of the amount recycled (by weight). Facilities seldom track recovery rates for single loads, so the documentation may indicate an average recycling rate over a certain time period. (Processors are required to submit their annual recycling rates to NY State Department of Conservation--this is acceptable documentation of recycling rate.)
- Determine what constitutes an acceptable mixed load.
- Prevent contamination of the recyclable items. Most processors will reject mixed loads contaminated by garbage or other unacceptable items.

Encourage and train the construction team.

Ultimately, it is the construction crews who will make or break the Waste Management Plan, so it is essential that they understand the goals and practical, everyday procedures. The Recycling Coordinator should be in charge of training. Strategies include:

- Provide training for each contractor and sub-contractor, as to the purpose, goals, and procedures.
- Discuss the goals and take suggestions for methods and additional materials.
- Keep it simple, tailoring the training to the work being done. For example, the framing sub-contractor doesn't need to know the procedures for cardboard or ceiling tiles.
- Keep updating everyone on changes in procedure or location throughout the project.
- Promote your success, to both the workers and the public. Consider motivational techniques or incentives.

Fight contamination.

With so many individuals on site, keeping everyday trash and disparate materials out of the recycling bins is an ongoing challenge. Strategies include:

- Make sure you understand the requirements of the waste processor and what constitutes contamination, such as rebar in concrete or any extraneous materials.
- Place general trash containers adjacent to each recycling container/location, and empty the trash containers regularly.
- Use small, wheeled containers for local collection, which can be consolidated into a larger container periodically.
- Keep street-side recycling containers securely covered when not supervised, to prevent contamination by the public.
- Designate a separate lunch area, and keep food out of work areas.

Monitor and collect paperwork.

Record keeping is important in the Waste Management Plan. Strategies include:

- Collect the paperwork for all C&D waste, as required by the specifications.
- Keep an ongoing log recording the information from the weight tickets and receipts.
- Monitor your recycling progress periodically, and compare the recycling rate to the goals/requirements established. The end of the job is not the time to discover a shortfall.
- Plan for a little higher amount than specified, to ensure that the final rate is sufficient.
- Organize weight tickets and receipts by the specific items in the Waste Management Plan to make tallies easier.

Case Study: New York City Housing Authority (NYCHA) Community Center Renovation & Additions, New York, NY

NYCHA has developed specifications for community center renovation or addition projects, to improve C&D management practices. Contractors are required to: a) employ processes that generate as little waste as possible due to poor planning, breakage, etc.; b) reuse, salvage or recycle as many materials as are economically feasible to; and c) take a proactive role in ensuring all subcontractors and suppliers participate in waste reduction and recovery efforts.

Contractors submit a one page waste management plan as part of the contracting process. The plan is meant to: a) estimate the types and quantities of waste generated by the job; b) identify disposal options and costs; c) identify alternatives to disposal for materials, including wood, concrete, asphalt, metal, corrugated cardboard and appliances; d) describe material handling procedures; and e) identify facilities that will be used for re-use or recycling.

The specifications were developed several years ago, and 10 to 15 community center renovations or additions have occurred since then. However, only one contractor has filled out a waste management plan, and Wesley Springer in the NYCHA Design Department admits that there are enforcement problems. While the spec allows NYCHA to withhold payment for noncompliance, this enforcement mechanism has not been used. Springer also says that more education of NYCHA inspectors would allow better tracking and enforcement on the job site. He also notes that Wicks Law is partially responsible for some difficulties, since the general contractor does not have the appropriate level of control. NYCHA is in the process of revising its specification to get greater compliance.

The one contractor that did fill out waste management plan, did so for a project at Lehman Village Houses. The data provided does not include tonnage, but indicates that approximately one-half the volume was diverted from landfill, for an avoided cost of about \$5,000. The materials that were recovered include: 20 doors, 10 windows, granite, aluminum, brick, cabinets, large appliances, window guards, fencing and clean fill. The aluminum and fill materials were recycled, and the rest of the materials were re-used by NYCHA.

Buy recycled.

Purchasing recycled products is good for the environment and for public relations, and it creates markets for the C&D waste you're trying to recycle. Strategies include:

- Submit recycled products when they meet the specifications.
- Use recycled materials for job site uses, such as temporary construction, office supplies, and collection containers.
- Consider the wide range of commonly available recycled products, including drywall, steel products, insulation, concrete/concrete products, fiberboard, plastic lumber, roofing, and flooring.

Prevent waste on the job site.

Preventing waste has more benefits than recycling, both environmentally and economically. Strategies include:

- Order materials accurately and as needed, to minimize the risk of damage.
- Protect materials from multiple-handling, weather conditions, theft, and damage from construction activities.
- Reuse materials on site, if approved by the Architect. Possibilities include mulch from land-clearing, debris/wood, or aggregate from the crushed rock of excavation. Include this in your Plan percentage.
- Select suppliers that take back packaging, pallets, unused or scrap materials. Include this in your Plan percentage.
- Maintain quality control and contractor coordination to minimize construction work that needs to be redone. This can be difficult under Wicks Law with four independent contractors, but communication, schedule coordination, and prompt inspections can help.

Review for salvage prior to demolition.

Selective demolition, often called de-construction, can yield usable building products for use on the project, for repairs or for another project. Architectural elements such as railings, doors and decorative elements are easy targets, but integral building components also can be recovered. Examples include divided-light windows, flooring, stonework, and structural elements. Relatively new finish elements, like carpeting, can be donated to not-for-profit groups. Practical salvage balances the material's condition, value, ease of removal, staging requirements, labor costs and the availability of a potential recipient. Strategies include:

- Identify potentially reusable materials before demolition, and evaluate their value, ease of removal and processing necessary (e.g. removal of nails).
- Be creative in seeking end-users for salvaged materials—sell it, donate it, give it away or use it on the project site. Programs like Habitat for Humanity and Materials for the Arts are happy to take surplus and reusable building materials and contents.
- Work with building management to save components for future repairs in a renovated building. Examples include locksets, doors, stone base and light fixtures.

Case Study: Civic Stadium/PGE Park Renovation, Portland, OR

In 2000/2001, Portland's event and athletic stadium underwent a major renovation. During this process, both standard and innovative recovery methods were employed. These included: on-site reuse or use in other area projects of more than 5,000 tons of concrete; recycling or salvage of 350 tons of structural and ornamental steel and more than 81 tons of dry waste (including a large amount of wood); reuse of all of the asphalt and most of the artificial turf; and use of stadium seats to fabricate countertops and interior finishes for the stadium's suites and brew pub. Projected savings over disposal: \$2 million out of a \$38.5 million project.

3

IMPLEMENTATION RESOURCES

The DDC Office of Sustainable Design and Construction is seeking to improve the reuse/recycling of construction and demolition (C&D) waste on DDC projects. To assist consultants, the DDC is providing the following resources -- to be edited for inclusion in project documents:

1. A list of INTERNET RESOURCES follows.
2. SPECIFICATION SECTION 01505: Construction and Demolition Waste Management, and related Sections. Two versions are included, and one of these must be included in the specifications for all DDC projects.
 - TYPICAL PROJECTS. This version sets a target goal for recycling and requires a Waste Management Plan and the collection of documentation
 - LEED PROJECTS. This version requires that specific minimum percentage of C&D waste be recycled, e.g. 50% or 75% by weight, as required to meet the U.S. Green Building Council's LEED requirements (version 2.1) for Construction Waste Management credit.

This can be downloaded from OSD's website: www.nyc.gov/buildnyc/ddcgreen

3. SAMPLE WASTE MANAGEMENT PLAN. The specification Section 01505 requires submission of a Waste Management Plan. A mock submission is included as an example, on the Sustainable Design section of DDC's website. This can be downloaded from OSD's website: www.nyc.gov/buildnyc/ddcgreen

4. DDC's consultants and contractors may request a list of New York C&D waste processors and manufacturers of green materials by contacting greeninfo@ddc.nyc.gov.

Internet Resources

These not-for-profit internet resources may assist in your efforts to recycle and reuse construction and demolition waste. The list, compiled in June 2002, is certainly not complete; there are numerous other resource web sites, not-for-profit and commercial outlets. Contact greeninfo@ddc.nyc.gov for more information.

www.nyc.gov/buildnyc/ddcgreen - Web site of DDC's Office of Sustainable Design (OSD). The site contains C&D Waste specifications and a Sample Waste Management Plan, as well as specifications for materials with recycled content. This document and other sustainable design manuals are also available on OSD's web site.

www.wastematch.org - Web site of New York Wa\$teMatch, a NYC materials exchange service, linking generators of industrial and commercial waste by-products with local end-users. Wa\$teMatch has effectively located outlets for by-products such as pallets, shipping crates and other types of packaging. With a grant from the EPA and DOS, NY Wa\$teMatch has compiled a very extensive list of Recycling and Reuse Outlets for building materials in NY. Call 212-442-5219.

www.habitat.org - Web site of Habitat for Humanity, which has an NYC affiliate, Habitat for Humanity-New York City. HFH builds and rehabilitates housing for low-income families, and welcomes new construction materials and used furniture.

www.mfta.org - Web site of Materials for the Arts, a NYC-based organization that accepts donations for re-distribution to art and cultural organizations. MFA accepts items such as computer equipment, used furniture and lighting fixtures.

www.perscholas.org - Web site of Per Scholas, a Bronx-based non-profit that reconditions used computers for distribution to low-income families and educational institutions. When computers can no longer be reconditioned, Per Scholas recycles them.

www.nema.org/lamprecycle - Web site of the National Electrical Manufacturers Association, describing the benefits of lamp recycling and the state and federal regulations regarding mercury-containing lamps. The site provides a list of association companies that process or recycle spent mercury-containing lamps

www.shinglerecycling.org - Web site with comprehensive information on asphalt shingle recycling, including contaminant issues, processing techniques, end-markets and regulatory references.

www.epa.gov/epaoswer/non-hw/debris/ - Site of the U.S. Environmental Protection Agency that discusses construction and demolition waste issues, and links to other resources.

www.informinc.org/fact_CWPconstruction.php - Web Site of Inform, an independent research organization. One of their focus topics is waste prevention, and this site describes strategies for reducing waste and preventing pollution generated during building construction, renovation and demolition. Additional links are included.

www.usgbc.org - Web site of the US Green Buildings Council — the nation's leading coalition of companies, organizations and individuals in the green building industry. The Council administers the LEED (Leadership in Energy and Environmental Design) Green Building Rating System in the US.

www.dec.state.ny.us - Web site of New York State Department of Environmental Conservation. Offers information on the “Green Buildings Initiative” and green building legislation.

www.nerc.org - Web site of the Northeast Recycling Council, which is a source for news, conferences, resources and links. The Council covers the ten northeast states, including New York.

www.resourceventure.org/construction.htm - Web site of the Business and Industry Resource Venture of Seattle/King County. The site has information on sustainable design practices, in particular construction recycling. See their Contractor’s Guide.

www.ciwmb.ca.gov - Web site of the California Integrated Waste Management Board. Provides C&D recycling resources, including sample local ordinances encouraging recycling and case studies.

www.loadingdock.org - Web site of a Baltimore-based non-profit building materials reuse center that salvages reusable building materials such as flooring, electrical fixtures, toilets, doors, lumber and windows.