General Metal Edition

Ensure the reuse of structural elements by implementing a structured process built around traditional craftsmanship of shaping

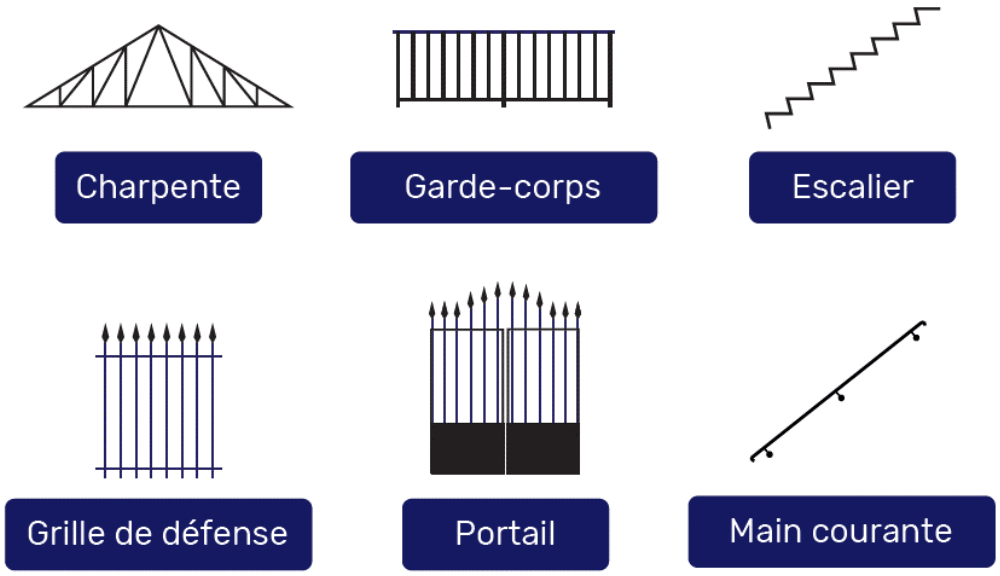


Image source: General Metal Edition

- **Context:** General Metal Edition is an SME that has shaping steel and metal for 20 years**.** Its field of intervention covers a wide area: from constructing industrial-scale structures and architectures to creating customised solutions for individuals (staircases, guardrails, etc.). Starting in 2020, it developed an activity for the reuse of metallic structures based on its expertise in terms of dismantling, transformation of salvaged metal elements, storage, design and assembly.
- **The challenge**: structure and develop an activity for the reuse of metal structures
- **Reclaimed materials:** various metal products and equipment: staircases, framework, guardrails, protective railings, gates, security grilles.

Contents

1. Risk control process at project level: the case of the "Maison des Canaux"

1/ Maison des Canaux: a pioneering project in terms of reuse of structural elements for the General Metal Edition company

Project owner: City of Paris

Agent of the winning consortium for the design-build contract: SCOP ((Société Coopérative et Participative) d'architectes Grand Huit

Project duration (second phase): 2019-2021. The first phase launched in 2017 concerned the interior renovation of the first and second floors for office use.

Key actions of the rehabilitation program:

- Renovation of the ground floor and basement of Maison des Canaux
- Construction of an outdoor terrace with a pergola
- Accessibility improvement to the premises
- Redesign of the heating system and overall improvement in the building's energy performance

Usable area: 860 m² + 150 m² of the terrace (floor area)

Study and constructionworks budget: 1.7 million euros including tax.

Reuse concerned many project batches. The awarded contractors of the various batches, and the design team were responsible for sourcing the materials.

Only the sourcing for the "metal structure" batch (terrace floor and pergola framework) for which **General Metal Edition** was the holder, was entrusted to Bellastock as the reuse assistant.

The client also actively participated in the sourcing of reuse materials (including the metal structure).

2/ The six steps of the reuse process

- **Step 1 - Definition and quantification of the need**: The architect defined the needs so as to allow Bellastock to evaluate the expected use for of metal beams. Very precise quantification work, element by element, was conducted by Bellastock.
- **Step 2 - Identifying the source:** Bellastock sourced from operators having stocks coming from selective deconstruction operations or new surplus stock and from sites set to be demolished. The City of Paris also contributed with its network of client partners. This made it possible to find a metal structure hangar set for demolition and located in Bondy on a site belonging to the developer Sequano operating in Seine-Saint-Denis.
- **Step 3 - Source diagnosis:** Bellastock conducted the diagnosis of this hangar according to a methodological approach: document study, preliminary site visits, inventory and listings, location plans, comprehensive listing, and drafting of the recommendations for dismantling, storage, conditioning, transport and preparation. The grade of the metal was identified using the DOE (as-built documentation) and the original construction date of the building. The structure of this hangar led to an oversizing of the structure of the terrace of Maison les Canaux, which provided an additional guarantee with respect to the risk of wear of the steel. **General Metal Edition** then intervened to validate this source.
- **Step 4 - Technical protocol for reuse**: drafted by Bellastock, it aimed to define the methods of proof, step by step (recommendations for deconstruction and transformation of the material, methods for evaluating performance, responsibility of the stakeholders) and to validate General Metal Edition's competence. This protocol was submitted to the project manager and to GME. The recommendations for dismantling the beams were forwarded to Sequano for integration in its demolition contract. The technical control office also provided feedback on the protocol and acknowledged the City of Paris's self-insurance for structural defects.
- **Step 5 - Validation of the method by the City of Paris's insurance consultant**: assessment of the risk in order to define whether it is necessary to take out specific structural defects insurance. At the request of its insurance consultant, the City of Paris made sure that General Metal's CCTP (special technical specifications) included the use of reused metal beams and requested a specific insurance certificate General Metal for this construction project. This guaranteed that the insurer was indeed informed of the reuse of the metal beams for the structure of the terrace. GME easily obtained this certificate without additional insurance premium.
- **Step 6 - Traceability**: Signature of a partnership agreement between the City of Paris, Est Ensemble and Sequano to establish economic, logistic, engineering and communication conditions for the free transfer of the metal beams followed by a signature of a transfer agreement by Sequano and GME defining the transfer of ownership of the metal beams and providing precise details on the beams concerned by the transfer. The transfer contract was appended to the partnership agreement. Verification in the DOE (as-built documentation) ensured that the reused structures are properly identified (technical documentation).

3/ The objectives of the technical protocol

Control of the technical-insurance risks associated with the "metal structure" batch entailed setting up a technical protocol validated by project stakeholders (project manager, client, reuse design office, technical controller, **General Metal Edition** and its insurance).

Objectives of the technical protocol in the insurance approach:

- Serve as a basis for dialogue between the various stakeholders in the project.
- Ensure information traceability.
- Evaluate the quality of the source based on visual self-inspections conducted by a qualified stakeholder (here, General Metal Edition).
- Define the chain of responsibility associated with the different stages of the construction project (dismantling, preparation, handling, storage).
- Objectify the degree of risk associated with the project.

4/ The content of the technical protocol

- **Study phase:**
  - Description of the key steps of the reuse process
  - Definition of the modalities for the verification of the aptitude for use of the reclaimed materials
  - Description of the modalities for the technical evaluation of the reclaimed materials: qualification of the source with respect to its intended use and methods of proof for performance assessment
  - Description of the modalities for guaranteeing these performances during all the stages of the project and for information traceability
  - Description of the chain of responsibility associated to the process

Stakeholders involved: Reuse project manager, **General Metal Edition,** Technical controller

- **Construction works phase:**
  - Description of the modalities for dismantling, reconditioning, storage, preparation of the reclaimed materials.

Stakeholders involved: Reuse design team, **General Metal Edition**, Technical controller, insurances of the various stakeholders.

Excerpt from the technical protocol – study phase

PERFORMANCES		MODES DE PREUVE			
Performances à fiabiliser/information à collecter	**Performances attendues**	**Modes de preuve préconisé** (autocontrôles, analyse documentaire, essais...)	**Périmètre de l'analyse**	**Quand**	**Qui**
1. LE GISEMENT : QUALIFICATION TECHNIQUE					
Gamme de produits Désignation commerciale/technique		**DOE ou constat visuel**	Par type de produits : - structure (profilés, tirants) ; - couverture ; - boulonnerie	Contrôle visuel unique : Diagnostic ressource	**Bellastock + GME**
Modes et état des assemblages		**DOE et constat visuel**	Par type de produits : - structure (profilés, tirants) ; - éléments de couverture / enveloppe	Contrôle visuel unique : Diagnostic ressource	**Bellastock + GME**
Géométrie (dimensions)		**DOE ou constat visuel**	Par type de produits : - structure (profilés, tirants) ; - boulonnerie	Contrôle visuel 1 : diagnostic ressource **Contrôle visuel 2 : sur site de dépose avant collecte** Contrôle visuel 3 : à réception en atelier de GME	**Contrôle 1 : Bellastock + GME** **Contrôle 2 : GME + présence Bellastock** **Contrôle 3 : GME**
Type de revêtement anti-corrosion et état		**DOE ou constat visuel**	Ensemble du gisement, pièce par pièce		
Respect des tolérances géométriques (déformations, etc)	Pas de déformations	**Constat visuel**	Ensemble du gisement et par type de produit : - profilés ; - boulonnerie		
Etat de l'élément (y compris assemblages) et caractéristiques mécaniques	Non soumis à incendie, non bleui, non plastifié ou écroui Non soumi au phénomène de fatigue Niveau d'enrouillement inférieur aux tolérances normatives admises (regarder notamment réduction de section résistante)	**Constat visuel et analyse documentaire (historique des solicitations éventuelles)**	Ensemble du gisement et par type de produit : - profilés ; - boulonnerie		
Solicitations environnementales vécues	Pas de solicitations pouvant altérer la qualité et les performances du gisement	**Constat visuel et analyse documentaire (historique des solicitations**	Ensemble de l'ouvrage		
Absence de substances dangereuses	Absence de plomb, amiante et autres composants	**Analyse documentaire**	Ensemble de l'ouvrage	Diagnostic ressource	**Bellastock**

***Source**:Bellastock - This technical protocol dedicated to carrying out the "metal structure" lot is based in part on the work conducted by the Fondation Bâtiment Energie (Building Energy Foundation) "methodology for diagnosing and evaluating residual performance for the re-use of steel frame elements", April 2021.*

Excerpt from the technical protocol – construction project phase

MÉTHODOLOGIE DE CONDITIONNEMENT		
Dénomination	*Préconisations Bellastock*	*Méthodologie utilisée*
Conditionnement / Stockage	Entreposage temporaire des éléments à plat (hors d'eau), sur cales, avec bâches pour protéger des intempéries	Protocole retenu : Cf. échanges AS démolition-Bouvelot-GME
Etiquettage	Étiquetage de chaque composant à conserver - Nomenclature à préciser - Préciser le support (résistance à l'eau, ne pas endommager le support) - Pour les pièces encombrantes prévoir plusieurs points de marquage - Plan de référence	
Sécurisation	A définir suivant le temps de stockage et la localisation du stock	
Auto-contrôle	**Contrôle visuel après dépose : description de l'état de l'élément (matériaux, élément, revêtement assemblages)** - voir onglet "Template_CR autocontroles" Critères : *Pas de déformations* *Non-soumis à un incendie, non bleui, non plastifié ou écroui, non déformé* *Non-soumis au phénomène de fatigue* *Niveau d'enrouillement* *Etat du revêtement anti-corrosion*	A faire par GME - supervisé par Bellastock Compléter étiquette matière

***Source**:Bellastock*

5/ The use of a monitoring register in the construction works phase

The previously described technical protocol was complemented with a "monitoring log" intended to ensure the compliance between the implemented works and the initial objectives described in the protocol.

REGISTRE DE SUIVI DU PROTOCOLE TECHNIQUE - TRAÇABILITÉ DU GISEMENT

PROTOCOLE TECHNIQUE									TRAÇABILITÉ	
ETAPES DU PROJET			PERFORMANCES		MODES DE PREUVE				INFORMATIONS COLLECTÉES	
n°	désignation	objectifs de l'étape	Performances à fiabiliser/information à collecter	Performances attendues	Modes de preuve (autocontrôles, analyse documentaire, essais...)	Périmètre de l'analyse	Quand	Qui	Description / justification	Source (en cas d'analyse documentaire)
1	DIAGNOSTIC RESSOURCE (BS)	Quantifier et qualifier le gisement (diagnostic visuel et documentaire)	Emploi d'origine		Constat visuel	Ensemble du gisement	Avant dépose du gisement (etudes de DIAG)	BS + GM		
2	EVALUATION TECHNIQUE	Qualifier le gisement : caractériques techniques complémentaires à définir	Revêtement anti-corrosion (type et état)	Conformité du revêtement au domaine de réemploi (cf. CCTP du lot à construire)	Autocontrôle visuel	Ensemble du gisement	Avant dépose du gisement	GM + TISCO (constat visuel sur la base de photos)	Peinture bon état. Pas de dégradation.Peinture anti-rouille.	
			Caractéristiques mécaniques propres au produit	Composition chimique Limite d'élasticité Résistance à la traction	Analyse documentaire + autocontrôle visuel	Ensemble du gisement		GM + TISCO (constat visuel sur la base de photos) + BS (recherche documentaire)	Analyse documentaire : pas de fiche technique mais un PC transmis par Sequano indiquant la construction du bâtiment en 1993. Les caractéristique mécaniques du gisement n'ayant pas été vérifiées par essais spécifiques (très bon état, connaissance de l'année de construction), il a été suggéré de surdimensionner l'ouvrage. Se référer aux notes de calcul et au plans d'EXE.	PC
3	TRAVAUX DE DÉCONSTRUCTION	Vérification du respect des préconisations	Respect des préconisations liées à la collecte, tri, manutention, entreposage	Préconisations liées à la collecte, tri, manutention, entreposage (cf. diagnostic ressource de Bellastock)	Contrôle visuel : documentation photo par l'entreprise de démolition	Ensemble du gisement	Pendant le chantier	MOE démolition (AS) + entreprise démolition	*A compléter (cf. document de suivi de AS démolition)*	
					Autocontrôle visuel	Ensemble du gisement		GM	*A compléter*	
		Qualifier le gisement après dépose	Etat de l'élément et caractéristiques mécaniques	Conformité avec l'état avant dépose	Autocontrôle visuel	Element par élément	Après collecte et entreposage e sur chantie	GM	*A compléter*	
			Géométrie	Conformité géométrique avec l'état avant dépose	Autocontrôle visuel	Element par élément			*A compléter*	
			Quantités	Conformité avec quantités demandées avant dépose	Autocontrôle visuel	Ensemble du gisement			*A compléter*	
		Traçabilité des éléments	Collecte des informations sur le gisement après dépose (géométrie, quantités, état de l'élément)	*Cf. lignes ci dessus*	Rédaction de l'"Etiquette matière" type	Ensemble du gisement		GM	*Compléter étiquette matière*	

Source: *Bellastock*

6/ The central role of General Metal Edition

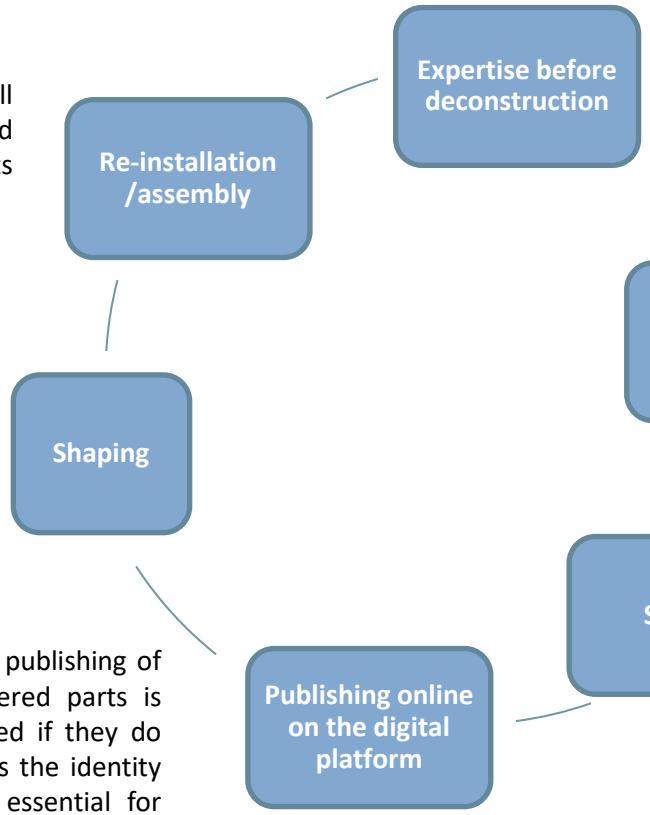
The company was involved during all the project steps related to metal structures reuse, and particularly :

- Provided an opinion on the proposed sources
- Qualified, quantified and validated the source (study phase)
- Validated the resource diagnosis
- Proposed a working methodology (human, material, etc. resources) in collaboration with the design team
- Elaborated an intervention schedule
- Provided a breakdown of cost estimates
- Designed the project based on the architect's request ("*Rather than starting with the design and finding the necessary pieces, we will begin with the recovered pieces and scraps in order to build the structure. A genuine box of Legos which acquires a lot of creativity. Thus 6-, 12- or 15-meter standard profile sections inadvertently cut to 5.50 metres by an undisciplined trader, along with small flat scrap less than one metre, have become riveted triangular beams*" - Julien Jussaume, CEO of General Metal Edition). This design also led to an oversizing of the structure which was validated by the structural design office
- Issued recommendations on the assembly of elements
- Received the materials and certified their compatibility with the intended location.

2. Risk control process at the company level

1/ Breakdown of GME's metal reuse activity

The Maison des Canaux project and requests from other clients for the reuse of metal structures has led General Metal Edition to create a complementary branch (Général Métal Réédition) dedicated to the reuse of structures of metal construction.
This activity is based on a structured and formalised approach revolving around the company's know-how. This process covers the following actions:



Expertise carried out before any deconstruction operation in order to ensure the economic and environmental interest of selective dismantling. As this selective dismantling is more expensive than conventional deconstruction, it makes sense only if the elements are of good quality.

If feasibility is established, selective dismantling based on the competences of GME is initiated and the dismantled elements are brought to GME's storage site to be reconditioned and shaped.

Local storage in a warehouse in adequate conditions.

For the most complex elements, publishing of existing DWG files of the recovered parts is required (the drawings are created if they do not already exist). This data forms the identity sheet of the product, and it is essential for online purchasers who have specific needs.

Shaping is not systematic. However, it is GME's core business. It makes it possible to adapt/adjust an element based on a specific request.

Reuse: General Metal Edition will proceed with installing reused elements while providing its contractual warranty.

2/ The storage, shaping workshop, digital platform triptych

General Metal Edition activity is based on three main elements:

1. **A 4,000 m² storage site** located near its Gonesse workshop (Val d'Oise).
2. **A workshop shaping of elements** so as to meet a specific demand or to create elements that satisfy market needs.
3. **A digital platform** dedicated to the reuse of metal structures (Sinfina.fr), which in particular displays the information on the products (weight, dimensions, volumes, price).

General Metal Edition's shaping workshop at Gonesse
Image source : CSTB

3/ Traceability and qualification of the elements for reuse

Re-use elements for metal frameworks
Image source : CSTB

It is crucial to ensure traceability of the information in a reuse process. The presence of GME at all of the steps of the value chain (diagnosis, dismantling, storage, shaping, assembly) makes it possible to correctly qualify the materials.

All of the products present on the platform possess a detailed sheet that presents their characteristics (weight, dimensions, volumes, price, etc.). For the more complex elements, DWG files are published (these data can then be used in a digital model), or when they are missing, it is General Metal Edition (GME) that creates the file by reshaping the part. These DWG files created by GME after inspection and refurbishment are guaranteed by GME, while those created by the original manufacturers of the structures are not.

In the general terms of sale on the platform, GME states that:

- "*The structures are sorted and selected with care and expertise;*
- *The Structures have been subject to maximum characterisation (DWG);*
- *The Structures were the inspected by GME to evaluate the technical performance of the Structures so that they are equivalent to those of new products.* »

4/ Methods for risk mitigation

- **Material selection**: General Metal Edition does not take back steel produced before the 1970s or those that have been subjected to fatigue or high load levels (for example, load-bearing beams of overhead cranes or metal elements coming from sensitive sites such as nuclear power plants). Likewise, powder-coated or galvanised beams are excluded.
- **Controlled reconditioning process**: GME has developed an approach that covers dismantling to reinstallation (see the three preceding slides) that guarantees information traceability and product quality.
- **Compensatory measures**: the reuse of structural elements systematically leads to oversized constructions (for example « an *S355 grade steel will be reclaimed as an S235 grade steel, which has lower strength* ")

5/ Insurance approach

All the elements described previously, combined with its carpentry installation expertise, allow GME to have the ten-year insurance that states that the company is insured for the supply and installation of reused structures on all its projects. For the Maison des Canaux project, General Metal Edition had requested a specific certificate from its insurer mentioning reuse.

Conclusion on the good practices linked to insurance

From the insurance of a reused structure…

The Maison des Canaux rehabilitation project is exemplary in terms of its circularity. This led to creating a "metal structure" lot entirely built with reuse elements (structure of the floor of the terrace and framework of the pergola). The good practices in terms of insurance were:

- **Competence in reuse** in the project manager consortium (Bellastock)
- **A technical protocol intended to control the technical-insurance risks**: this protocol defines the modalities for validating the aptitude for use of the metal profiles, the traceability of the actions carried out and the responsibilities of the stakeholders in the project.
- **Involvement of the stakeholders**: the implementation of this protocol and the collaboration of all of the stakeholders (project manager, project owner, reuse project manager, the General Metal Edition company) as well as their respective insurances made it possible to successfully ensure the structure.

… to the insurance for a reuse activity

The expertise and formalism developed during the Maison des Canaux project was adopted by GME to develop its business into the installation structures with reused metal elements and the sale of reused metal elements via a digital platform. The company's insurance covers its activity in all its projects, the insurance aspect is not studied on a case-by-case basis for each project. The reuse activity recognised by the insurance is based on **the company's expertise, know-how and the adoption a structured process** that revolves around the following points:

- **Technical control** for all of the reuse operations (diagnosis, selective dismantling, shaping and installation) and for design methods adapted to reused elements (precautions and compensatory measures), which make it possible to guarantee the quality of the elements used and minimise the risks of a claim.
- **Adapted infrastructure**: a storage space, adequate technical and logistics resources.
- A **traceability** system for products.

Authors : Frédéric BOUGRAIN et Capucine GAUTIER (CSTB)
Contributor : Hugo TOPALOV (Bellastock)
Reviewer : Victor MEESTERS (ROTOR)
Acknowledgment: Isabelle LARDIN (Ville de Paris) et Julien JUSSAUME (General Metal Edition)
October 2023