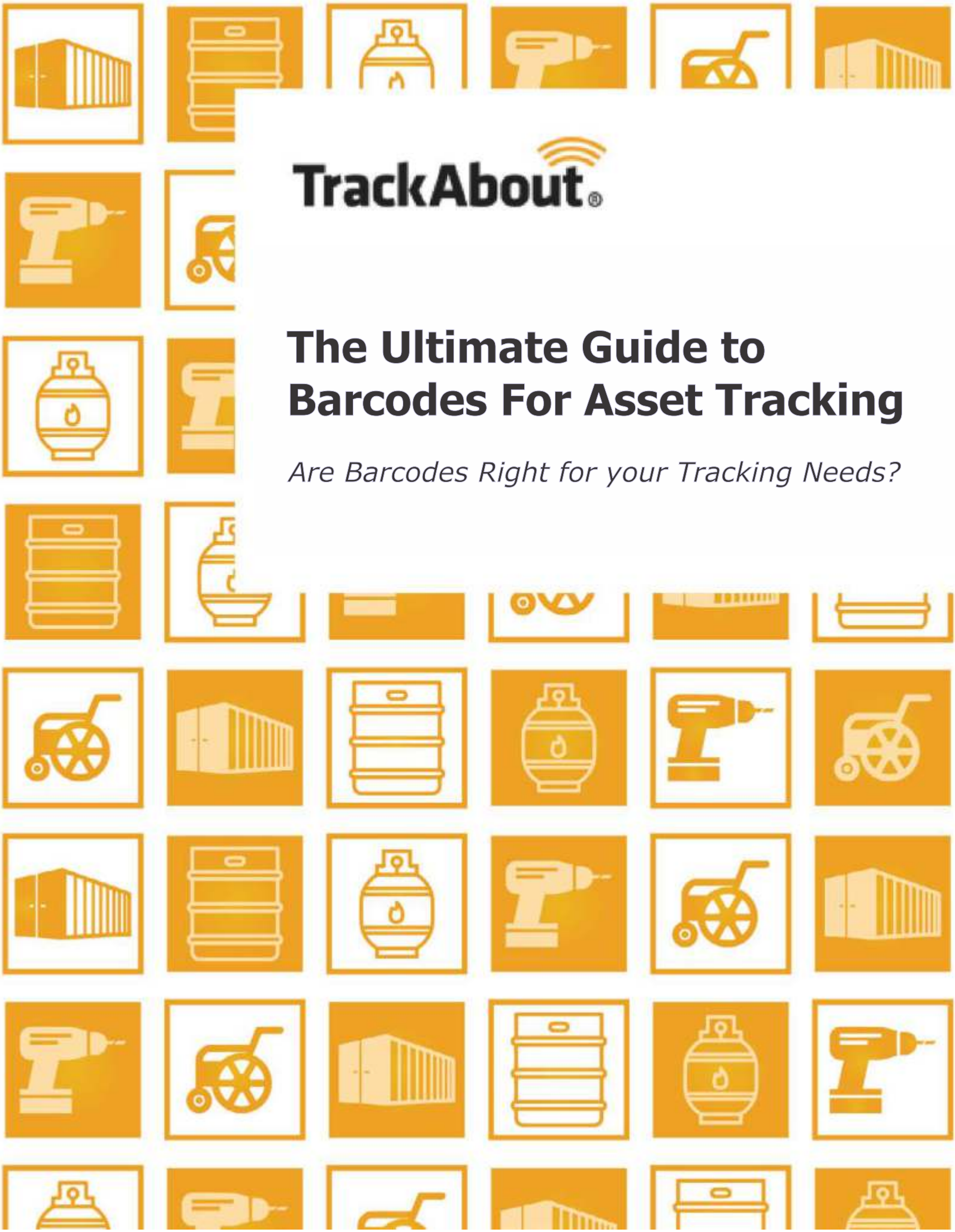

TrackAbout®

The Ultimate Guide to Barcodes For Asset Tracking

Are Barcodes Right for your Tracking Needs?

Contents

Introduction

Barcodes are everywhere, and it's not difficult to understand why. They are an inexpensive and relatively simple way to keep track of objects by scanning the numeric information encoded within.

You probably don't give them much thought. Yet they've revolutionized the way we operate our economy. The ability to quickly scan codes into a database allows goods move around faster, a key factor in an efficient supply and delivery chain.

And while barcodes have changed the way the retail system works, the same thing applies to returnable asset tracking. Because barcodes have made it easier than ever to know where your assets are at any given time.

Construction companies have tools that move around. Breweries distribute kegs. Manufacturers deploy delivery racks. Gas companies have thousands of cylinders in the field. Each one of these items represents a financial investment, and the owners want them back.

The trouble with returnables is that most people don't give them a second thought. Receive an expensive delivery rack with your shipment? Put it in a corner and forget about it. Have some empty gas cylinders? They're probably pushed to the side- somewhere.

Using barcodes in an asset tracking solution like TrackAbout can be a cost-effective and powerful way to keep tabs on your inventory.
Get in touch with us to learn more.

But what is it about these little bars and numbers that makes them so versatile?

Let's take a look at why barcodes represent the most common solution for tracking returnable assets, and how to know if it's the right one for you.

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A BRIEF HISTORY OF BARCODES

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Barcodes have been around for two generations, and as technology has progressed their use has increased exponentially.

1948

The First barcode was invented by **Norman J Woodland and Bernard Silver**. It featured a bullseye design.

1952

Woodland and Silver receive a **patent for their invention**, however technology hurdles made it impractical

1960s

The Association of American Railroads sponsors the **KarTrak Barcode System**, The size of a refrigerator featuring 13 horizontal labels.

1973

The **Committee on Uniform Grocery Product Code** recommends barcodes be used on most products in U.S.

1974

On June 26, 1974, a pack of Wrigley's gum became the **first commercially-scanned UPC barcode**

1974

The **Code 39** is invented, becoming the first alphanumeric barcode technology

1975

90% of all US rail cars carry **KarTrak labels**, although the program would be abandoned 3 years later.

1982

The first **charge coupled device (CCD) scanner** is introduced, paving the way for widespread adoption of barcode scanning technology

1986

The first **handheld fixed-beam laser scanner** is patented.

1999

The two-dimensional **QR code** is unveiled in Japan

2005

Airlines begin **printing barcodes on passenger boarding passes** to speed up the process.

2008

Mobile phones gain the required technology to be able to display barcodes

2016

Scanning using the normal camera on mobile phones and tablets reaches performance parity with earlier laser scanners.

Sources:
http://www.logisticshalloffame.net/images/mitglieder/woodland-silver-laurer/bernard-silver.jpg
http://i.dailymail.co.uk/i/pix/2012/12/14/article-2247894-1680E0AC000005DC-303_306x423.jpg
https://www.accuratedata.com/wordpress/wp-content/uploads/2017/08/KarTrak.jpg
https://cdn.theatlantic.com/assets/media/img/mt/2014/11/bar_code/lead_large.jpg
http://p.globalsources.com/IMAGES/PDT/BIG/238/B1054523238.jpg
https://cdn.barcodesinc.com/images/models/lg/Wasp/ccdlr.jpg

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The barcode was first invented in 1948 by Norman J. Woodland and Bernard Silver. Studying at Drexel University, they envisioned a system that tried to improve the movement of goods in the Supermarket Industry.

The design they came up with resembled a bullseye, and it would prove to be an idea that was before it's time. The technology of the day simply wasn't up to the challenge of seeing it to fruition.

The first linear barcode was developed in the 1960's and was implemented by the Association of American Railroads for the proposed KarTrak ACI (Automatic Car Identification) System. The system was large - about the size of a refrigerator - and primitive by today's standard. While it was a pioneering system, the project was canceled in 1978 due to inefficiencies and accuracy problems.

During this time, the UPC barcode was also introduced. The first time a commercial sale was made by scanning a barcode was a pack of Wrigley's gum, on June 26, 1974. The gum and the receipt are currently on display at the Smithsonian.

Widespread adoption of barcode scanning wouldn't come about until the 1980s. Fueled by the supermarket industry, the introduction of the first CCD (charged couple device) scanner in 1982, and the first laser handheld scanner in 1986 made large-scale deployment feasible.

Since then, barcodes have been deployed in a variety of different situations. Airlines began printing barcodes on passenger boarding passes in 2005, and in 2008 smartphones gained the technology to be able to both read and display them.

Only in 2016 did the combination of better cameras, faster processors and more advanced optical processing algorithms come together to make every smartphone and tablet into a very good barcode scanner. The widespread adoption of these devices at all levels of organizations gives a very broad capability to allow every person to rapidly collect accurate data. The humble barcode, with it's roots going back 60 years, is the foundational technology to make this all possible.

Click here to learn more about the history of barcodes.

Symbology:Types of Barcodes Used Today

A barcode's symbology refers to how it uses different lines or shapes to represent the data encoded in it. While there have been several iterations of barcodes, and many others used today, they generally fall into two main categories: 1D (linear) and 2D barcodes.

Each has their advantages and disadvantages.

1D (Linear) Barcodes vs 2D Barcodes

VS

The primary advantages of 1D linear barcodes are that:

- They can be scanned with both laser scanners and imager scanners. If you already have laser scanners that you want to keep using, you will need to use 1D barcodes.
- They are compact and have a rectangular shape which fits well on some kinds of assets
- You can print them yourself (and cheaply) if needed.

The primary advantages of 2D Barcodes

- They can sometimes scan slightly faster or further away with imagers than 1D barcodes.
- They can have a built-in redundancy which lets them still scan when slightly damaged.
- They generally have a more square shape which fits well on some kinds of assets.
- They can hold more data (Though we recommend having the barcode just be an ID number. The data about the asset is stored in a database and is not encoded inside the barcode itself).

Common Types of 1D Linear Barcodes

Code 39

Code 39 barcode

Invented in 1974, the Code 39 configuration remains one of the most popular types of barcodes today. It features:

- *Letters (A through Z, uppercase)*
- *Numbers (0 through 9)*
- *Special characters (- . $ / + % and space)*

The advantage of Code 39 is that they are incredibly easy to make. You can get fonts that encode them easily, and then print them yourself (although we'll explain later why this isn't recommended for asset tracking).

Click here to learn more about Code 39 barcodes.

Code 128

Code 128 barcode

Code 128 appears similar to a Code 39 barcode, except they're more compact and can encode an entire ASCII character set - uppercase letters, numbers, and punctuation symbols.

However, because of the way information is encoded - incorporating three code sets - they are more difficult to produce yourself. The advantage, though, is that it can hold more information and the smaller profile makes it easier to affix to items.

Click here to learn more about Code 128 barcodes.

Common Kinds of 2D Barcodes

QR Codes

QR Code

QR codes, short for "Quick Response", were invented in Japan in 1994. These two-dimensional matrix barcodes use four code sets. For that reason, it's popular in manufacturing due to the larger amount of information it can hold - over 4,000 characters for larger QR codes.

QR Codes also have data redundancy built into them so that a partially damaged QR code will commonly still scan correctly.

QR Codes must generally be at least 1 inch (2.5 centimeters) on each side to be large enough to be usefully scanned. In some cases this is too large of a barcode label.

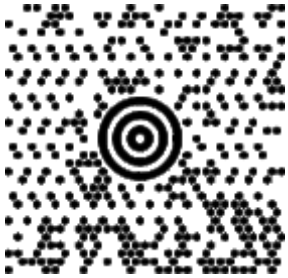
Data Matrix

Data Matrix barcode

Similar to QR codes, Data Matrix barcodes are a two-dimensional matrix type of information coding. Data Matrix can be very small and still scan. This is typically the choice for very small, square barcode labels.

Like PDF417, they are a popular choice among postal services.

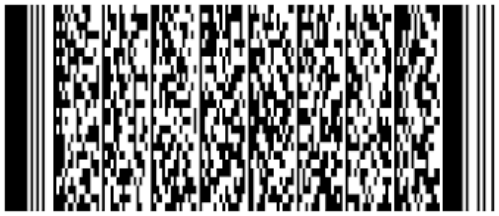
MaxiCode



MaxiCode barcode

A third type of 2D barcode, MaxiCode, is favored by the package delivery industry. Similar to QR and Data Matrix codes, it's a machine-readable barcode that can only encode up to 93 characters but can be linked with others to increase its information store. We do not see this used for asset tracking.

PDF417



PDF417 barcode

If you've flown in the past decade, you've seen a PDF417 barcode printed on your boarding pass. They are also frequently used in postal services due to the fact they can be easily printed yet do not take up much space. We do not see this used for asset tracking.

Creating Barcodes

The great thing about barcodes is that they are relatively cheap and easy to produce. How easy they are to create depends on the type, as well as a variety of other factors.

When you're using barcodes as part of an asset tracking solution, TrackAbout can supply you with inexpensive high-quality barcodes to ensure that they work for you. **Get in touch** to learn more.

Selecting Barcode Numbers

When tracking an inventory of assets, every barcode must have its own unique ID number. There is an organization, GS1 organization, that will standardize numbers across industries. They allow an organizationto register abarcode prefix and then use the remaining space for unique numbers. In practice, we do not see companies using these standards in their asset tracking projects. The registration process is too expensive for most projects and unnecessary.

The key for an asset tracking project is to ensure that the barcode numbers you will use are unique internally and among all your supply chain partners who might use them too.

Using Serial Numbers as Barcode Numbers

Many assets have a unique serial number imprinted on them from their manufacturer. It might at first seem like this would be a good number to use for a tracking number. So if some of your assets have pre-printed barcodes from the manufacturer you can use those and for the rest of your assets you will custom print barcode labels that match the serial number.

We do *not* recommend this practice. We do *not* recommend using manufacturer's serial numbers to print your own barcodes. Because:

- Serial numbers are not guaranteed to be unique. Different manufacturer can use the same serial numbers and in some cases even the same manufacturer may reuse serial numbers.
- The formats for serial numbers can vary across manufacturers forcing you to allow many allowable formats into your tracking system. This reduces accuracy.
- It is a best practice to have a single standard barcode number format that includes something called a check digit (more on this below). This ensures valid data collection at the time of scanning.
- Serial numbers can contain special characters, letter, numbers and even spaces. This makes it less clear for your people what the tracking number is. As in… Do we use the space or ignore it? What about the dashes?
- Printing your own barcodes is generally a bad idea because:
  - Now you need printers located where you label assets. These printers are another source of potential failure and complexity in your process. You need to make sure they are working and do not run out of ink or labels.
  - When labelling several assets at once it is possible to put the custom printed serial number labels on the wrong assets.
  - Custom printed labels are usually of lower quality than labels purchased from a professional printing company and will need to be replaced more often.

Rather than making your barcode match your serial number, we instead recommend setting up a cross-reference where a standardized barcode label is linked to an asset's serial number.

Click here to learn more about the dangers of using serial numbers as tracking Ids.

Check Digit

A check digit is a commonly used technique to avoid errors when manually inputting a number. Credit card numbers and bank account numbers both commonly contain a check digit. We strongly recommend the use of standardized tracking number formats which include a check digit.

The check digit used by TrackAbout is called Mod 10 or the Luhn Algorithm. It is a final digit that is calculated from the previous digits in the barcode number. For example, pictured is part of a roll of barcode labels. There are two identical labels per asset. The top 3 pairs of labels at the top of the image end in these numbers:

...980**5,** ...981**4,** ...982**3**

See that the 980, 981, 982 are just sequential numbers. The "5" at the end of the first number is a check digit. If a user was to mis-key this number by typing ... 9085 instead of 9805 the check digit will not 'check' and the system will reject this number as an invalid input.

Multiple Barcodes Per Asset (Usually 2)

We recommend multiple identical barcodes placed on each asset. This gives you redundancy. If one of the labels is destroyed you still have a second label to fall back on. Multiple labels also make it faster to scan because it is more likely a label will be oriented toward the person doing the scanning.

For most applications we recommend 2 labels per asset, but there are cases where 3 or 4 identical labels make sense.

Usually the only case for 1 label per asset is when the asset is so small that there is not room for multiple labels.

Affixing and Scanning Barcodes

Successfully deploying barcodes in your asset tracking system means you have to both affix them properly and then scan the information. Let's take a look at best practices for each.

Affixing Barcodes

Ensure that your barcode is durable

Not all barcodes are created equally, and superior ones will be both durable and hold the image longer without fading. Printing your own may save money, but you may likely have to go to the additional expense of replacing them down the road - not to mention the impact it will have on your ability to track your assets. Therefore, having them professionally produced is usually a safer choice.

The only case for printing yourself is for small projects of usually less than 200 assets and where the assets are kept indoors and not subjected to much abuse. Labels for office furniture is a good example where printing yourself can make sense.

Barcode placement is important

Ensure it is placed in an area of the asset that will be easily accessible yet isn't unduly exposed to the elements, if possible. Having easy access will speed up the scanning process.

A good adhesive is mandatory

If you want your labels to last for many years, then the adhesive matters. Generally labels you can print yourself have relatively weak adhesives and will fail with age or when exposed to extreme temperatures. Commercially printed labels come in a variety of adhesives and can be very strong and long-lasting. Be sure to use a permanent adhesive that will work on our asset surface and will last for many years and within the temperature ranges that your assets will experience.

Scanning Barcodes

There are two main types of (portable) devices used to scan barcodes: rugged handheld scanners and smartphones. Both have their advantages and disadvantages.

Rugged handheld devices are durable, built to last, and can scan barcodes quickly. The drawback is that they can be expensive and are larger and heavier

Smartphones are everywhere, and they offer the advantage of being relatively inexpensive. But they are less rugged if dropped. They also don't have dedicated scanning imagers. They scan slightly slower than dedicated imagers. This does not matter when scanning a few assets at a time, but makes a difference when scanning dozens of assets at a time.

You can learn more about scanning options in **The Definitive Guide to Asset Tracking.**

See the table below. This is for typical scan times under typical conditions. If a user is only scanning a few assets there is almost no difference in the time it takes to perform the scans. If however the user must scan 100 assets at a time then you are probably better off with a rugged device with a dedicated imager scanner. Most of our clients use smartphones for most users and some then augment this with rugged devices for their users that do the most scanning.

Type of Barcode Scanner	Typical Time to Scan Each Asset
Rugged Device with a Dedicated Imager Scanner	1.0 second per scan
Smartphone/Tablet Camera	1.35 seconds per scan*

** It is worth noting that this time continues to decline slightly every year and get closer to the scan time for dedicated imagers.*

Should You Use Barcodes For Asset Tracking?

In the majority of cases, barcodes are an ideal solution for asset tracking. However, they may not always be the right choice for you. Here are some of the advantages and disadvantages of using barcodes.

Barcode Advantages

Low Cost

Barcodes cost pennies each, yet can hold unique IDs useful for asset tracking.

Versatile

Not only can barcodes be scanned by different devices giving you flexibility in the type of technology you use, they are so simple and effective that they give you a wide degree of choice of where and when to use them.

Fast

Today's scanners can read barcodes very quickly, giving you a robust way of tracking your assets.

Accurate

Assuming you are using high-quality barcodes, they are considered an accurate way to provide a unique ID to all of your returnable assets.

Easy to Use

They're easy to attach to an item and even easier to scan.

Future-Proof

Barcodes in their various formats have been with us for years and will be supported far into the future. This makes them relatively 'future-proof'.

Barcode Disadvantages

You Need a Line of Sight

Unlike other types of tracking technology such as RFID and GPS, you have to make sure you have a line of sight to the barcode.

Manual Orientation

In addition to having a line of sight, you need to orient the scanner to line up with the barcode, which can slow down the process if you have objects positioned differently.

Low-Quality Barcodes

If you select a lower-quality barcode, you risk it falling off or degrading to the point where your scanner is no longer able to read it.

Barcodes vs Other Tracking Technology

Thanks to their versatility, ease of use, and low cost, barcodes are a great choice for any item that is touched by a person when it is moved around. However, you may want to consider active systems such as RFID and GPS when:

- You need to know the location of assets that move around on their own, such as vehicles
- You need to be able to scan dozens or hundreds of objects at once
- You need to be able to scan items remotely
- You need to be able to have an object "call home" and give you technical information, such as its map position

At the end of the day, barcodes are still the asset tracking technology of choice for most situations. It's simply a question of acquiring barcodes, affixing them, and scanning them into the database.

TrackAbout is a leader in helping companies keep track of their returnable assets. We'll help you choose the tracking technology that works for you and set you up with a powerful but easy to use system to manage your assets.

Get in touch to learn more about how barcodes can save you money and help you protect your investment.

Live Demo and Free Consultation

TrackAbout's easy to use system puts complete asset management at your fingertips. Contact us today for a live demo and free consultation about a solution that can revolutionize how you track your assets.