

# Abbey Glen Subdivision with Fiber-Reinforced Concrete

## Fiber-Reinforced Concrete vs. Traditional Steel Reinforcement



The Abbey Glen subdivision in Lubbock, TX is located at the northwest corner of Slide Road and I 14th Street. This residential neighborhood is an upscale subdivision and one of the newest custom home communities in the area with over 260 custom home lots and a private park. The streets in the subdivision mark the first major use of fiber-reinforced concrete in a paving application in Lubbock, TX.

### Why Fiber-Reinforced Concrete Pavements?

Synthetic macrofibers are currently being used globally in slab-on-ground and paving applications to replace conventional temperature and shrinkage steel reinforcement. The reasons for the increased use of synthetic macrofibers include:

- Post-crack flexural performance
- Increased toughness they provide in concrete
- Ease of use and cost effectiveness

Based on the successful use of fiber-reinforced concrete in other slab-on-ground applications, Master Builders Solutions marketing and sales teams collaborated with the local sales representative and concrete producer, Triple C Ready Mix to work with the City of Lubbock's engineering department to gain approval of Master Builders Solutions' MasterFiber<sup>®</sup> MAC Matrix synthetic macrofiber as an alternative for temperature and shrinkage reinforcement in concrete pavements vs. traditional steel reinforcement.

This effort included a test pavement project in 2014, which was inspected at the beginning of March 2016 and found to be one of the best streets compared to others nearby where #4 (13M) steel reinforcing bars were used. Subsequently, the City of Lubbock gave the engineering firm, Hugo Green & Associates, Inc., permission to specify the synthetic macrofiber for use in three local residential developments.

## Project Profile

Fiber-Reinforced Concrete vs. Traditional Steel Reinforcement Joint

### Project Details

In 2016, the first phase of fiber-reinforced concrete paving started at the Abbey Glen subdivision.

The 6-in. (150 mm) thick pavements are reinforced with 7.5 lb/ yd<sup>3</sup> (4.5 kg/m<sup>3</sup>) of MasterFiber MAC Matrix synthetic macrofiber with a total area of approximately 167,000 ft<sup>2</sup> (15,500 m<sup>2</sup>), requiring nearly 3,100 yd<sup>3</sup> (2,370 m<sup>3</sup>) of fiber-reinforced concrete. MasterFiber MAC Matrix synthetic macrofiber was used in lieu of the conventional #4 (13M) steel bars that the City of Lubbock would otherwise have required in the concrete pavements.

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**Michael G. Keenum, P.E.,**

CFM Division Director of Engineering/City Engineer  
City of Lubbock Texas

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After approximately 1,250 yd<sup>3</sup> (955 m<sup>3</sup>) of concreting, the pavement construction was 4 weeks ahead of schedule and the project team, including Hugo Reed & Associates, Inc., were

pleased with the outcome and excited to move forward with the use of the fiber-reinforced concrete in all four phases of the project. Overall, more than 12,000 yd<sup>3</sup> (9,170 m<sup>3</sup>) of fiber-reinforced concrete paving was completed at the Abbey Glen subdivision by the end of 2017.

### Pavement Performance

With hardly any cracking, the performance of the fiber-reinforced concrete pavements in the Abbey Glen subdivision has exceeded the expectations of the project team and the City of Lubbock’s engineering department. “We have been very impressed with the quality and durability of the fiber reinforced concrete that was installed in the Abbey Glen subdivision,” said Michael G. Keenum, P.E., CFM Division Director of Engineering/City Engineer, City of Lubbock Texas. “It has performed as advertised with almost no cracking and no detectable separation. We look forward to having this product installed in future subdivisions work.”

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***“You can immediately tell the difference in the finished product. Not only does the fiber-reinforced concrete paving look better, with far few cracks, but it also holds up much better to regular and construction traffic.”***

**Scott Reed, Owner,**

Black Diamond Slipform and Paving

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### Abbey Glen Subdivision Then and Now

Comparison photos of the concrete surface of Abbey Glen subdivision in 2016 vs. 2019.



In the geotechnical report issued prior to the start of concrete paving at the Oakmont Estates, an adjacent subdivision located at 114th Street between Quarter and the south side of Slide Road, it was reported that the Potential Vertical Rise (PVR), that is the anticipated soil vertical movements at the site because of soil moisture changes, was not significant based on plasticity testing. The PVR was estimated by the TxDOT procedure Tex-124-E for "Potential Vertical Rise (PVR)." Because of the proximity of the Oakmont Estates subdivision, it can be inferred that the PVR of the soils at the Abbey Glen subdivision are also not significant. Nevertheless, it is Master Builders Solutions' expectation that even in areas where PVR is more significant fiber-reinforced concrete pavements containing adequate amounts of MasterFiber MAC Matrix synthetic macrofiber will perform well, because of the significantly increased flexural toughness imparted to the concrete through the fiber reinforcement.

"You can immediately tell the difference in the finished product. Not only does the fiber-reinforced concrete paving look better, with far fewer cracks, but it also holds up much better to regular and construction traffic," said Scott Reed, Owner – Black Diamond Slipform and Paving.

### Recognition of Performance Benefits

Because of the superior performance of the fiber-reinforced concrete streets placed in the City of Lubbock, including the Abbey Glen subdivision, MasterFiber MAC Matrix synthetic macrofiber was approved for use in other concrete parking lot and city paving projects in the City of Lubbock and Wolfforth. "Using fiber over traditional rebar reinforcement was a big win for us on this project," continues Scott Reed, Owner – Black Diamond Slipform and Paving. "We saved our client a good amount of time and money, which has led to more jobs being awarded to us."

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### Side by Side Comparison

Compared to the concrete pavements in the Abbey Glen subdivision, the streets in Oakmont Estates which were constructed a few years earlier starting from 2012 are steel reinforced. The reinforcement consists of #4 (13M) conventional steel bars spaced at 18 in. (460 mm) to minimize cracking due to temperature and shrinkage stresses. However, multiple mid-panel full-depth cracks and circular cracking around joints have developed in a few of the concrete panels (see photos).

#### **MasterFiber Reinforcement:**

*concrete surface from Abbey Glen subdivision*



#### **Traditional Steel Reinforcement:**

*concrete surface from adjacent subdivision Oakmont Estates*



**Project Profile**

Fiber-Reinforced Concrete vs. Traditional Steel Reinforcement Joint

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**About Master Builders Solutions**

Master Builders Solutions is a leading global manufacturer of concrete admixtures, as well as other sustainable solutions for the construction industry, focussed on delivering its vision: **Inspiring people to build better.** Master Builders Solutions provides value-added technology and market-leading R&D capabilities to improve the performance of construction

materials and to enable the reduction of CO2 emissions in the production of concrete. Founded in 1909, Master Builders Solutions has ca. 1600 employees operating 35 production sites globally, supporting their customers in mastering their building challenges of today – for a decarbonised future.

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**Master Builders Solutions Admixtures US, LLC**

23700 Chagrin Boulevard  
Beachwood, OH 44122 USA  
(800) 628-9990

[master-builders-solutions.com/en-us](https://master-builders-solutions.com/en-us)  
[admixtures@masterbuilders.com](mailto:admixtures@masterbuilders.com)

**Master Builders Solutions Canada, Inc**

1800 Clark Boulevard  
Brampton, Ontario L6T 4M7 CANADA  
(289) 360-1300

